One Medical

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8/6/2019

##Import dependencies/packages

##Import datasets

```
setwd("~/Box/Analytics Team/Research/Research projects/One medical")
mbr <- read_csv("spacex_members.csv")
clm <- read_csv("spacex_claims.csv")
rx <- read_csv("spacex_pharmacy.csv")
ctr <- read_csv("SpaceX Health Center Claims 1016 to 1217.csv")
vrt <- read_csv("SpaceX Member Virtual Services 0721919.csv")
feesch <- read_csv("FeesRVU_by_CPT_01_20190723_140220_392625.csv")
```

##Custom functions

```
getmode <- function(v) {
   force(v)
   uniqv <- unique(v)
   uniqv[which.max(tabulate(match(v, uniqv)))]
}
```

##Format claims to combine CH claims to OM Center claims

```
clm_dol = clm
clm_dol$`Metaclaims Analytics Medical Allowed Amount` = as.numeric(gsub("[\\$,]", "", clm_dol$`Metaclair
clm_dol$`Metaclaims Analytics Medical First Name` = str_to_title(clm_dol$`Metaclaims Analytics Medical F
clm_dol$`Metaclaims Analytics Medical Last Name` = str_to_title(clm_dol$`Metaclaims Analytics Medical La

clm_sub = clm_dol %>%
  mutate(personid = (`Metaclaims Analytics Medical Person ID`),
         female = (`Metaclaims Analytics Medical Gender`=="F"),
         firstname = `Metaclaims Analytics Medical First Name`,
         lastname = `Metaclaims Analytics Medical Last Name`,
         pos = `Metaclaims Analytics Medical Service Category Detail`,
         dos = `Metaclaims Analytics Medical Service Date Start Date`,
         om_flag = ((`Metaclaims Analytics Medical Billing Prov Bill ID`=="460695495")&(`Metaclaims Anal
                    ((`Metaclaims Analytics Medical Billing Prov Bill ID`=="460741732")&(`Metaclaims Anal
                    ((`Metaclaims Analytics Medical Billing Prov Bill ID`=="362169147")&(`Metaclaims Anal
                    ((`Metaclaims Analytics Medical Billing Prov Bill ID`=="814542216")&(`Metaclaims Anal
                    ((`Metaclaims Analytics Medical Billing Prov Bill ID`=="383906267")&(`Metaclaims Anal
                    ((`Metaclaims Analytics Medical Billing Prov Bill ID`=="471708588")&(`Metaclaims Anal
                    ((`Metaclaims Analytics Medical Billing Prov Bill ID`=="271346767")&(`Metaclaims Anal
                    ((`Metaclaims Analytics Medical Billing Prov Bill ID`=="911942315")&(`Metaclaims Anal
                    ((`Metaclaims Analytics Medical Billing Prov Bill ID`=="812141065")&(`Metaclaims Anal
                    ((`Metaclaims Analytics Medical Billing Prov Bill ID`=="452282261")&(`Metaclaims Anal
                    ((`Metaclaims Analytics Medical Billing Prov Bill ID`=="273009385")&(`Metaclaims Anal
                    ((`Metaclaims Analytics Medical Billing Prov Bill ID`=="812980907")&(`Metaclaims Anal
                    ((`Metaclaims Analytics Medical Billing Prov Bill ID`=="270243800")&(`Metaclaims Anal
```

```
                    ((`Metaclaims Analytics Medical Billing Prov Bill ID`=="020619758")&(`Metaclaims Anal
                    ((`Metaclaims Analytics Medical Billing Prov Bill ID`=="461773122")&(`Metaclaims Anal
                    ((`Metaclaims Analytics Medical Billing Prov Bill ID`=="800925565")&(`Metaclaims Anal
                    ((`Metaclaims Analytics Medical Billing Prov Bill ID`=="800925565")&(`Metaclaims Anal
          em_flag = ((`Metaclaims Analytics Medical Procedure Code`=='99201')|
                     (`Metaclaims Analytics Medical Procedure Code`=='99202')|
                     (`Metaclaims Analytics Medical Procedure Code`=='99203')|
                     (`Metaclaims Analytics Medical Procedure Code`=='99204')|
                     (`Metaclaims Analytics Medical Procedure Code`=='99205')|
                     (`Metaclaims Analytics Medical Procedure Code`=='99211')|
                     (`Metaclaims Analytics Medical Procedure Code`=='99212')|
                     (`Metaclaims Analytics Medical Procedure Code`=='99213')|
                     (`Metaclaims Analytics Medical Procedure Code`=='99214')|
                     (`Metaclaims Analytics Medical Procedure Code`=='99215'))) %>%
  filter(dos<="2019-07-01") %>%
  group_by(firstname,lastname,female,pos) %>%
  summarise(om_flag = as.logical(getmode(om_flag)),
            em_flag = as.logical(getmode(em_flag)),
            diag1 = getmode(`Metaclaims Analytics Medical Principal Diag`),
            cost_md = sum(`Metaclaims Analytics Medical Allowed Amount`),
            cnt_flag = 0) %>%
  ungroup()

ctr_sub = ctr
ctr_sub$Name = str_to_title(ctr$Name)
ctr_sub$Name = toTitleCase(ctr$Name)
ctr_sub$`Primary Diagnosis` = as.character(gsub("[\\.]", "", ctr_sub$`Primary Diagnosis`))

ctr_sub = ctr_sub %>%
  separate("Name",c("lastname","empty","firstname"),sep = "([\\, \\ ])", extra="drop", warn = "left") %
  mutate(dos = mdy(DOS)) %>%
  group_by(firstname,lastname,Gender,Billing)%>%
  mutate(female= getmode((Gender=='F')),
         om_flag = as.logical(1),
         em_flag = ((CPT=='99201')|
                    (CPT=='99202')|
                    (CPT=='99203')|
                    (CPT=='99204')|
                    (CPT=='99205')|
                    (CPT=='99211')|
                    (CPT=='99212')|
                    (CPT=='99213')|
                    (CPT=='99214')|
                    (CPT=='99215')),
         pt_flag = ((Billing=='KSPANGENBE[109557787]')|
                    (Billing=='MMARCUCCIL[109565213]')),
         mh_flag = ((Billing=='Darling[109701110]')|
                      (Billing=='GFRANK[109571370]')),
         diag1 = getmode(`Primary Diagnosis`),
         pos = ("Office Visits - PCP"))  %>%
  select(firstname,lastname,female,em_flag,om_flag,diag1,pos,CPT,pt_flag,mh_flag) %>%
  ungroup()
```

```
ctr_sub$pos[ctr_sub$mh_flag==1] = "Mental Health and Substance Use"
ctr_sub$pos[ctr_sub$pt_flag==1] = "Physical Medicine"


feesch_sub = feesch %>%
  mutate(cost_md = Fee) %>%
  select(CPT,cost_md)

ctr_sub = full_join(ctr_sub,feesch_sub,by="CPT") %>%
  select(-CPT) %>%
  mutate(cnt_flag = 1)
```

OM attribution and utilization counts

```
clm_tot = bind_rows(clm_sub,ctr_sub)

clm_tot = clm_tot %>%
  group_by(firstname, lastname,female) %>%
  filter(any(em_flag==1)) %>%
  summarise(om_flag = getmode(om_flag[em_flag==1]),
            diag1 = getmode(diag1),
            count_drugadmin = sum((pos=="Administered drug inc Chemo")|(pos=="Administration of drug")|
            cost_drugadmin =sum((cost_md[pos=="Administered drug inc Chemo"|pos=="Administration of drug
            count_surg = sum((pos=="Anesthesia")|(pos=="Outpatient Surgery")|(pos=="Surgery")|(pos=="Su
            cost_surg = sum(cost_md[(pos=="Anesthesia")|(pos=="Outpatient Surgery")|(pos=="Surgery")|(po
            count_maternity = sum(pos=="Labor and Delivery" | pos=="Newborns"),
            cost_maternity = sum(cost_md[(pos=="Labor and Delivery" | pos=="Newborns")]),
            count_labs = sum(pos=="Lab Pathology" | pos=="Pathology Lab"),
            cost_labs = sum(cost_md[(pos=="Lab Pathology" | pos=="Pathology Lab")]),
            count_er = sum(pos=="Emergency Room"),
            cost_er = sum(cost_md[pos=="Emergency Room"]),
            count_rads = sum(pos=="Radiology"),
            cost_rads = sum(cost_md[pos=="Radiology"]),
            count_hosp = sum(pos=="Inpatient Visits"|pos=="Medical"),
            cost_hosp = sum(cost_md[pos=="Inpatient Visits"|pos=="Medical"]),
            count_pcp = sum((pos=="Office Visits - PCP")|(pos=="Preventive Visits - PCP")),
            cost_pcp = sum((cost_md[pos=="Office Visits - PCP"|pos=="Preventive Visits - PCP"])),
            count_spec = sum((pos=="Office Visits - Specialist")|(pos=="Preventive Visits - Specialist"
            cost_spec = sum((cost_md[pos=="Office Visits - Specialist"|pos=="Preventive Visits - Specia
            count_mh = sum(pos=="Mental Health and Substance Use" | pos=="Psychiatry"),
            cost_mh = sum(cost_md[pos=="Mental Health and Substance Use" | pos=="Psychiatry"]),
            count_pt = sum(pos=="Physical Medicine"),
            cost_pt = sum(cost_md[pos=="Physical Medicine"]),
            cost_other = sum(cost_md[(pos!="Administered drug inc Chemo")|(pos!="Administration of drug
            cost_md = sum(cost_other+cost_drugadmin+cost_surg+cost_maternity+cost_labs+cost_er+cost_rads
            cnt_flag = max(cnt_flag)) %>%
  select(firstname,lastname, female,om_flag,diag1,cost_md,count_er,cost_er,count_hosp,cost_hosp,count_p
  ungroup()
clm_tot$female[is.na(clm_tot$female)==1]=0
```

##Member org

```
mbr_sub = mbr
mbr_sub$`Analytics Member Months First Name` = str_to_title(mbr_sub$`Analytics Member Months First Name
mbr_sub$`Analytics Member Months Last Name` = str_to_title(mbr_sub$`Analytics Member Months Last Name`)

mbr_sub = mbr_sub %>%
  mutate(personid = `Analytics Member Months Person ID`) %>%
  group_by(personid) %>%
  mutate(start = min(`Analytics Member Months Start Date`),
         end = max(`Analytics Member Months End Date`),
         age = mean(`Analytics Member Months Age`),
         female = (`Analytics Member Months Gender`=='F'),
         firstname = `Analytics Member Months First Name`,
         lastname = `Analytics Member Months Last Name`,
         membermo = interval(start,end)/months(1),
         DOB = `Analytics Member Months Date of Birth Date`) %>%
  select(age, female, personid, firstname, lastname, membermo, DOB) %>%
  distinct()
```

##Add in pharmacy claims

```
rx_dol = rx
rx_dol$`Analytics Claims Pharmacy Allowed Amount` = as.numeric(gsub("[\\$,]", "", rx_dol$`Analytics Cla
rx_dol$`Analytics Claims Pharmacy First Name` = str_to_title(rx_dol$`Analytics Claims Pharmacy First Na
rx_dol$`Analytics Claims Pharmacy Last Name` = str_to_title(rx_dol$`Analytics Claims Pharmacy Last Name

rx_sub = rx_dol %>%
  mutate(personid = `Analytics Claims Pharmacy Person ID`) %>%
  group_by(personid) %>%
  mutate(female = (`Analytics Claims Pharmacy Gender`=="F"),
         firstname = `Analytics Claims Pharmacy First Name`,
         lastname = `Analytics Claims Pharmacy Last Name`,
         cost_rx = sum(`Analytics Claims Pharmacy Allowed Amount`)) %>%
  select(female, personid, firstname,lastname,cost_rx) %>%
  distinct()
```

##Virtual visits

```
vrt_sub = vrt
vrt_sub$`dphi.patient_first_name` = str_to_title(vrt_sub$`dphi.patient_first_name`)
vrt_sub$`dphi.patient_last_name` = str_to_title(vrt_sub$`dphi.patient_last_name`)

vrt_sub = vrt_sub %>%
  mutate(vrt_flag = 1,
         firstname = dphi.patient_first_name,
         lastname = dphi.patient_last_name) %>%
  select(firstname, lastname, vrt_flag) %>%
  distinct()
```

##HCC risk score

```
spacex_dat = mbr_sub %>%
  full_join(clm_tot, by = c("firstname","lastname","female")) %>%
  full_join(rx_sub, by = c("firstname","lastname","female")) %>%
```

```
  full_join(vrt_sub, by = c("firstname","lastname")) %>%
  mutate(om_flag = replace_na(om_flag,0),
         vrt_flag = replace_na(vrt_flag,0),
         cnt_flag = replace_na(cnt_flag,0)) %>%
  distinct()

PERSON = spacex_dat %>%
  ungroup() %>%
  mutate(HICNO = personid.x,
         SEX = if_else(female==1,"F","M"),
         DOB = DOB,
         MCAID = 0,
         NMCAID = 0,
         OREC = 0) %>%
  select(HICNO, SEX, MCAID, NMCAID, OREC, DOB) %>%
  filter(!is.na(HICNO))

cmshcc_map <- load_cmshcc_map()

DIAG = spacex_dat %>%
  ungroup() %>%
  mutate(HICNO = personid.x,
         DX = diag1) %>%
  select(HICNO, DX) %>%
  filter(!is.na(HICNO))

hcc = evaluate_v22_2017(PERSON, DIAG, "Community_NonDual_Aged")
```

CCS cat

```
ccs <- read_csv("ccs_dx_icd10cm_2018_1.csv")
ccs  =ccs %>%
  mutate(diag1 = `ICD-10-CM CODE`,
         ccs = `CCS CATEGORY`) %>%
  select(diag1, ccs)
```

##Pre-match

```
spacex_dat_ana = mbr_sub %>%
  full_join(clm_tot, by = c("firstname","lastname","female")) %>%
  full_join(rx_sub, by = c("firstname","lastname","female")) %>%
  full_join(vrt_sub, by = c("firstname","lastname")) %>%
  full_join(hcc, by = c("personid.x" = "HICNO")) %>%
  left_join(ccs, c("diag1")) %>%
  mutate(age = mean(age),
         om_flag = replace_na(om_flag,0),
         vrt_flag = replace_na(vrt_flag,0),
         cnt_flag = replace_na(cnt_flag,0),
         cost_md = replace_na(cost_md,0),
         count_er = replace_na(count_er,0),
         cost_er = replace_na(cost_er,0),
```

```
        count_hosp = replace_na(count_hosp,0),
        cost_hosp = replace_na(cost_hosp,0),
        count_pcp = replace_na(count_pcp,0),
        cost_pcp = replace_na(cost_pcp,0),
        count_spec = replace_na(count_spec,0),
        cost_spec = replace_na(cost_spec,0),
        count_mh = replace_na(count_mh,0),
        count_pt = replace_na(count_pt,0),
        cost_pt = replace_na(cost_pt,0),
        cost_mh = replace_na(cost_mh,0),
        cost_rx = replace_na(cost_rx,0),
        count_drugadmin = replace_na(count_drugadmin,0),
        cost_drugadmin = replace_na(cost_drugadmin,0),
        count_surg = replace_na(count_surg,0),
        cost_surg = replace_na(cost_surg,0),
        count_maternity = replace_na(count_maternity,0),
        cost_maternity = replace_na(cost_maternity,0),
        count_labs = replace_na(count_labs,0),
        cost_labs = replace_na(cost_labs, 0),
        count_rads = replace_na(count_rads, 0),
        cost_rads = replace_na(cost_rads,0),
        hcc = Community_NonDual_Aged,
        hcc = replace_na(hcc,0)) %>%
ungroup() %>%
group_by(personid.x) %>%
filter(membermo>0) %>%
summarise(mm = mean(membermo,na.rm=T),
          age = mean(age, na.rm=TRUE),
          age = replace_na(age,0),
          female = mean(female, na.rm=TRUE),
          female = replace_na(female,0),
          cost_md = (sum(cost_md, na.rm=TRUE)+sum(cost_rx, na.rm=TRUE))/mm,
          cost_rx = sum(cost_rx, na.rm=TRUE)/mm,
          cost_er = sum(cost_er, na.rm=TRUE)/mm,
          cost_hosp = sum(cost_hosp, na.rm=TRUE)/mm,
          cost_pcp = sum(cost_pcp, na.rm=TRUE)/mm,
          cost_spec = sum(cost_spec, na.rm=TRUE)/mm,
          cost_mh = sum(cost_mh, na.rm=TRUE)/mm,
          cost_pt = sum(cost_pt, na.rm=TRUE)/mm,
          count_er = sum(count_er, na.rm=TRUE)/mm,
          count_hosp = sum(count_hosp, na.rm=TRUE)/mm,
          count_pcp = sum(count_pcp, na.rm=TRUE)/mm,
          count_spec = sum(count_spec, na.rm=TRUE)/mm,
          count_mh = sum(count_mh, na.rm=TRUE)/mm,
          count_pt = sum(count_pt, na.rm=TRUE)/mm,
          count_drugadmin = sum(count_drugadmin, na.rm=TRUE)/mm,
          cost_drugadmin = sum(cost_drugadmin, na.rm=TRUE)/mm,
          count_surg = sum(count_surg, na.rm=TRUE)/mm,
          cost_surg = sum(cost_surg, na.rm=TRUE)/mm,
          count_maternity = sum(count_maternity, na.rm=TRUE)/mm,
          cost_maternity = sum(cost_maternity, na.rm=TRUE)/mm,
          count_labs = sum(count_labs, na.rm=TRUE)/mm,
          cost_labs = sum(cost_labs, na.rm=TRUE)/mm,
```

```
            count_rads = sum(count_rads, na.rm=TRUE)/mm,
            cost_rads = sum(cost_rads, na.rm=TRUE)/mm,
            vrt_flag = mean(vrt_flag,na.rm=T),
            cnt_flag = mean(cnt_flag,na.rm=T),
            om_flag = mean(om_flag, na.rm=T),
            hcc = mean(hcc,na.rm=T),
            ccs = mean(ccs,na.rm=T),
            hcc = replace_na(hcc,0),
            ccs = replace_na(ccs,0),
            ccs = as.factor(ccs),
            diag1 = getmode(`diag1`),
            diag1 = replace_na(diag1,0))


summary(spacex_dat_ana)
```

```
##    personid.x           mm               age            female
##  Min.   :182259   Min.   : 0.5484   Min.   : 0.00   Min.   :0.0000
##  1st Qu.:226312   1st Qu.:13.9677   1st Qu.:16.00   1st Qu.:0.0000
##  Median :241713   Median :28.9677   Median :27.50   Median :0.0000
##  Mean   :342188   Mean   :28.4455   Mean   :26.84   Mean   :0.3985
##  3rd Qu.:428072   3rd Qu.:47.9677   3rd Qu.:35.50   3rd Qu.:1.0000
##  Max.   :845685   Max.   :47.9677   Max.   :79.33   Max.   :1.0000
##
##     cost_md            cost_rx            cost_er
##  Min.   :     0.0   Min.   :    0.00   Min.   :   0.00
##  1st Qu.:     0.0   1st Qu.:    0.00   1st Qu.:   0.00
##  Median :    56.4   Median :    0.64   Median :   0.00
##  Mean   :   604.2   Mean   :   51.56   Mean   :  33.76
##  3rd Qu.:   307.1   3rd Qu.:    9.39   3rd Qu.:   0.00
##  Max.   :340677.8   Max.   :83586.29   Max.   :8490.56
##
##    cost_hosp           cost_pcp           cost_spec
##  Min.   :    0.00   Min.   :    0.000   Min.   :   0.000
##  1st Qu.:    0.00   1st Qu.:    0.000   1st Qu.:   0.000
##  Median :    0.00   Median :    5.199   Median :   0.000
##  Mean   :   28.32   Mean   :   27.397   Mean   :   8.158
##  3rd Qu.:    0.00   3rd Qu.:   24.397   3rd Qu.:   6.880
##  Max.   :28593.94   Max.   :13483.698   Max.   :2008.533
##
##     cost_mh            cost_pt           count_er
##  Min.   :   0.000   Min.   :   0.00   Min.   :0.000000
##  1st Qu.:   0.000   1st Qu.:   0.00   1st Qu.:0.000000
##  Median :   0.000   Median :   0.00   Median :0.000000
##  Mean   :   7.934   Mean   :  12.25   Mean   :0.008133
##  3rd Qu.:   0.000   3rd Qu.:   0.00   3rd Qu.:0.000000
##  Max.   :7718.156   Max.   :5155.26   Max.   :2.268908
##
##    count_hosp         count_pcp          count_spec         count_mh
##  Min.   :0.000000   Min.   : 0.00000   Min.   :0.00000   Min.   : 0.000
##  1st Qu.:0.000000   1st Qu.: 0.00000   1st Qu.:0.00000   1st Qu.: 0.000
##  Median :0.000000   Median : 0.03229   Median :0.00000   Median : 0.000
```

```
##  Mean   :0.004855   Mean   : 0.09051   Mean   :0.01978   Mean   : 0.011
##  3rd Qu.:0.000000   3rd Qu.: 0.06674   3rd Qu.:0.02327   3rd Qu.: 0.000
##  Max.   :4.573770   Max.   :65.39303   Max.   :4.57377   Max.   :12.338
##
##     count_pt        count_drugadmin   cost_drugadmin       count_surg
##  Min.   : 0.00000   Min.   :0.00000   Min.   :    0.00   Min.   :0.00000
##  1st Qu.: 0.00000   1st Qu.:0.00000   1st Qu.:    0.00   1st Qu.:0.00000
##  Median : 0.00000   Median :0.00000   Median :    0.00   Median :0.00000
##  Mean   : 0.05423   Mean   :0.03278   Mean   :   13.86   Mean   :0.02116
##  3rd Qu.: 0.00000   3rd Qu.:0.04170   3rd Qu.:    0.87   3rd Qu.:0.02085
##  Max.   :50.92857   Max.   :9.14754   Max.   :39264.82   Max.   :4.57377
##
##    cost_surg          count_maternity    cost_maternity
##  Min.   :     0.00   Min.   :0.000000   Min.   :    0.00
##  1st Qu.:     0.00   1st Qu.:0.000000   1st Qu.:    0.00
##  Median :     0.00   Median :0.000000   Median :    0.00
##  Mean   :    78.11   Mean   :0.001876   Mean   :   23.41
##  3rd Qu.:     1.05   3rd Qu.:0.000000   3rd Qu.:    0.00
##  Max.   :156868.07   Max.   :1.476190   Max.   :36858.13
##
##    count_labs         cost_labs           count_rads
##  Min.   :0.00000   Min.   :    0.000   Min.   :0.00000
##  1st Qu.:0.00000   1st Qu.:    0.000   1st Qu.:0.00000
##  Median :0.00000   Median :    0.000   Median :0.00000
##  Mean   :0.02896   Mean   :   13.354   Mean   :0.01593
##  3rd Qu.:0.03344   3rd Qu.:    6.281   3rd Qu.:0.02085
##  Max.   :6.06522   Max.   :17678.204   Max.   :4.57377
##
##    cost_rads           vrt_flag          cnt_flag          om_flag
##  Min.   :   0.000   Min.   :0.00000   Min.   :0.00000   Min.   :0.0000
##  1st Qu.:   0.000   1st Qu.:0.00000   1st Qu.:0.00000   1st Qu.:0.0000
##  Median :   0.000   Median :0.00000   Median :0.00000   Median :0.0000
##  Mean   :  14.773   Mean   :0.05486   Mean   :0.09405   Mean   :0.1402
##  3rd Qu.:   2.126   3rd Qu.:0.00000   3rd Qu.:0.00000   3rd Qu.:0.0000
##  Max.   :8152.876   Max.   :1.00000   Max.   :1.00000   Max.   :1.0000
##
##       hcc               ccs          diag1
##  Min.   :0.00000   0      :7966   Length:21967
##  1st Qu.:0.00000   256    :3707   Class :character
##  Median :0.00000   10     :1154   Mode  :character
##  Mean   :0.01151   126    : 704
##  3rd Qu.:0.00000   205    : 524
##  Max.   :2.62500   211    : 393
##                    (Other):7519
```

##Matching

```
spacex_dat_cov <- c('age', 'female', 'mm', 'membermo', 'hcc', 'ccs', 'diag1')

spacex_dat_nomiss = as.data.frame(spacex_dat_ana)

start_time <- Sys.time()

spacex_dat_nomiss = spacex_dat_nomiss %>%
```

```
  mutate(hcccat = 1*(hcc==0) + 2*(hcc>0)&(hcc<1) + 3*(hcc>=1))

set.seed(100)
mod_match <- matchit(om_flag ~ age + female + ccs + hcccat + mm,
                     method = "nearest", data = spacex_dat_nomiss)
end_time <- Sys.time()

end_time - start_time
```

```
## Time difference of 31.83275 secs
```

```
mod_match
```

```
##
## Call:
## matchit(formula = om_flag ~ age + female + ccs + hcccat + mm,
##     data = spacex_dat_nomiss, method = "nearest")
##
## Sample sizes:
##           Control Treated
## All         18887    3080
## Matched      3080    3080
## Unmatched   15807       0
## Discarded       0       0
```

```
dta_m <- match.data(mod_match)
dim(dta_m)
```

```
## [1] 6160   37
```

```
dta_m %>%
  group_by(om_flag) %>%
  select(one_of(spacex_dat_cov)) %>%
  summarise_all(funs(mean))
```

```
## # A tibble: 2 x 7
##   om_flag   age female    mm     hcc   ccs diag1
##     <dbl> <dbl>  <dbl> <dbl>   <dbl> <dbl> <dbl>
## 1       0  33.1  0.192  33.9 0.0149     NA    NA
## 2       1  31.8  0.197  34.4 0.00816    NA    NA
```

```
# continuous
print(CreateTableOne(vars = c("age", "female", "hcc", "mm", "ccs"), strata = "om_flag", data = dta_m, t
```

```
##                     Stratified by om_flag
##                      0             1             p      test SMD
##   n                  3080          3080
##   age (mean (SD))    33.05 (14.79) 31.82 (9.24)  <0.001       0.100
##   female (mean (SD)) 0.19 (0.39)   0.20 (0.40)   0.652        0.011
##   hcc (mean (SD))    0.01 (0.07)   0.01 (0.05)   <0.001       0.107
```

```
##   mm (mean (SD))     33.90 (13.96) 34.45 (13.62) 0.124       0.039
##   ccs (%)                                        NaN         0.222
##      0               0 (0.0)       0 (0.0)
##      134             37 (1.2)      40 (1.3)
##      93              9 (0.3)       12 (0.4)
##      205             200 (6.5)     174 (5.6)
##      259             25 (0.8)      20 (0.6)
##      120             2 (0.1)       2 (0.1)
##      176             20 (0.6)      16 (0.5)
##      94              38 (1.2)      43 (1.4)
##      92              41 (1.3)      39 (1.3)
##      246             10 (0.3)      9 (0.3)
##      204             138 (4.5)     159 (5.2)
##      5               2 (0.1)       1 (0.0)
##      256             552 (17.9)    582 (18.9)
##      138             11 (0.4)      10 (0.3)
##      196             1 (0.0)       1 (0.0)
##      10              343 (11.1)    336 (10.9)
##      126             178 (5.8)     159 (5.2)
##      171             4 (0.1)       4 (0.1)
##      203             4 (0.1)       2 (0.1)
##      7               44 (1.4)      45 (1.5)
##      212             9 (0.3)       9 (0.3)
##      211             151 (4.9)     172 (5.6)
##      250             10 (0.3)      8 (0.3)
##      244             31 (1.0)      27 (0.9)
##      143             8 (0.3)       9 (0.3)
##      98              36 (1.2)      23 (0.7)
##      155             28 (0.9)      26 (0.8)
##      106             14 (0.5)      12 (0.4)
##      197             30 (1.0)      22 (0.7)
##      651             61 (2.0)      88 (2.9)
##      200             78 (2.5)      74 (2.4)
##      163             13 (0.4)      16 (0.5)
##      245             8 (0.3)       6 (0.2)
##      96              2 (0.1)       2 (0.1)
##      247             8 (0.3)       8 (0.3)
##      185             0 (0.0)       0 (0.0)
##      258             29 (0.9)      17 (0.6)
##      133             48 (1.6)      49 (1.6)
##      183             0 (0.0)       0 (0.0)
##      232             114 (3.7)     119 (3.9)
##      255             26 (0.8)      29 (0.9)
##      253             42 (1.4)      30 (1.0)
##      144             0 (0.0)       0 (0.0)
##      53              3 (0.1)       6 (0.2)
##      95              19 (0.6)      17 (0.6)
##      243             2 (0.1)       3 (0.1)
##      99              0 (0.0)       0 (0.0)
##      174             0 (0.0)       1 (0.0)
##      124             1 (0.0)       2 (0.1)
##      239             23 (0.7)      17 (0.6)
##      102             29 (0.9)      24 (0.8)
##      661             1 (0.0)       3 (0.1)
```

```
##      49              17 (0.6)      19 (0.6)
##      48              11 (0.4)      8 (0.3)
##      209             3 (0.1)       2 (0.1)
##      251             55 (1.8)      54 (1.8)
##      225             21 (0.7)      22 (0.7)
##      59              3 (0.1)       2 (0.1)
##      90              22 (0.7)      22 (0.7)
##      657             54 (1.8)      49 (1.6)
##      100             0 (0.0)       0 (0.0)
##      58              14 (0.5)      12 (0.4)
##      652             29 (0.9)      25 (0.8)
##      87              0 (0.0)       0 (0.0)
##      166             18 (0.6)      18 (0.6)
##      121             0 (0.0)       1 (0.0)
##      25              0 (0.0)       0 (0.0)
##      137             4 (0.1)       8 (0.3)
##      236             28 (0.9)      30 (1.0)
##      91              18 (0.6)      16 (0.5)
##      168             0 (0.0)       3 (0.1)
##      230             6 (0.2)       4 (0.1)
##      147             3 (0.1)       3 (0.1)
##      44              6 (0.2)       6 (0.2)
##      198             15 (0.5)      14 (0.5)
##      122             1 (0.0)       2 (0.1)
##      217             0 (0.0)       0 (0.0)
##      47              13 (0.4)      10 (0.3)
##      195             0 (0.0)       0 (0.0)
##      257             0 (0.0)       2 (0.1)
##      159             14 (0.5)      12 (0.4)
##      130             0 (0.0)       0 (0.0)
##      127             0 (0.0)       0 (0.0)
##      88              3 (0.1)       2 (0.1)
##      160             4 (0.1)       3 (0.1)
##      51              3 (0.1)       4 (0.1)
##      128             34 (1.1)      24 (0.8)
##      4               17 (0.6)      18 (0.6)
##      252             21 (0.7)      15 (0.5)
##      125             13 (0.4)      10 (0.3)
##      650             4 (0.1)       7 (0.2)
##      229             11 (0.4)      16 (0.5)
##      123             10 (0.3)      11 (0.4)
##      89              0 (0.0)       0 (0.0)
##      52              0 (0.0)       1 (0.0)
##      84              31 (1.0)      31 (1.0)
##      167             2 (0.1)       7 (0.2)
##      154             10 (0.3)      8 (0.3)
##      8               0 (0.0)       1 (0.0)
##      6               0 (0.0)       0 (0.0)
##      175             1 (0.0)       2 (0.1)
##      56              0 (0.0)       0 (0.0)
##      181             2 (0.1)       2 (0.1)
##      140             2 (0.1)       2 (0.1)
##      213             0 (0.0)       0 (0.0)
##      39              0 (0.0)       0 (0.0)
```

```
##      101             0 (0.0)       0 (0.0)
##      237             0 (0.0)       0 (0.0)
##      29              0 (0.0)       0 (0.0)
##      142             2 (0.1)       3 (0.1)
##      54              2 (0.1)       3 (0.1)
##      215             0 (0.0)       1 (0.0)
##      158             0 (0.0)       1 (0.0)
##      149             1 (0.0)       1 (0.0)
##      235             7 (0.2)       9 (0.3)
##      187             0 (0.0)       0 (0.0)
##      655             0 (0.0)       0 (0.0)
##      153             0 (0.0)       1 (0.0)
##      145             0 (0.0)       0 (0.0)
##      231             3 (0.1)       2 (0.1)
##      117             6 (0.2)       8 (0.3)
##      14              0 (0.0)       0 (0.0)
##      83              0 (0.0)       0 (0.0)
##      50              2 (0.1)       1 (0.0)
##      660             4 (0.1)       5 (0.2)
##      86              0 (0.0)       0 (0.0)
##      135             3 (0.1)       2 (0.1)
##      161             0 (0.0)       0 (0.0)
##      670             0 (0.0)       1 (0.0)
##      2617            1 (0.0)       1 (0.0)
##      180             0 (0.0)       0 (0.0)
##      208             4 (0.1)       3 (0.1)
##      119             1 (0.0)       2 (0.1)
##      173             0 (0.0)       0 (0.0)
##      2               0 (0.0)       0 (0.0)
##      109             0 (0.0)       0 (0.0)
##      165             6 (0.2)       3 (0.1)
##      234             4 (0.1)       5 (0.2)
##      164             0 (0.0)       0 (0.0)
##      55              3 (0.1)       3 (0.1)
##      206             1 (0.0)       1 (0.0)
##      136             3 (0.1)       4 (0.1)
##      77              0 (0.0)       1 (0.0)
##      151             7 (0.2)       7 (0.2)
##      12              0 (0.0)       0 (0.0)
##      186             0 (0.0)       0 (0.0)
##      62              1 (0.0)       2 (0.1)
##      61              0 (0.0)       0 (0.0)
##      23              0 (0.0)       0 (0.0)
##      189             0 (0.0)       0 (0.0)
##      210             0 (0.0)       0 (0.0)
##      104             0 (0.0)       0 (0.0)
##      202             0 (0.0)       1 (0.0)
##      26              0 (0.0)       1 (0.0)
##      238             0 (0.0)       0 (0.0)
##      162             0 (0.0)       0 (0.0)
##      115             0 (0.0)       0 (0.0)
##      182             0 (0.0)       0 (0.0)
##      11              0 (0.0)       0 (0.0)
##      97              0 (0.0)       0 (0.0)
```

```
##      35              0 (0.0)       0 (0.0)
##      36              0 (0.0)       0 (0.0)
##      157             0 (0.0)       0 (0.0)
##      30              0 (0.0)       0 (0.0)
##      9               2 (0.1)       1 (0.0)
##      178             0 (0.0)       1 (0.0)
##      80              0 (0.0)       0 (0.0)
##      659             0 (0.0)       0 (0.0)
##      228             0 (0.0)       1 (0.0)
##      27              0 (0.0)       0 (0.0)
##      132             0 (0.0)       0 (0.0)
##      218             0 (0.0)       1 (0.0)
##      33              1 (0.0)       1 (0.0)
##      654             0 (0.0)       0 (0.0)
##      233             0 (0.0)       1 (0.0)
##      3               0 (0.0)       0 (0.0)
##      38              0 (0.0)       0 (0.0)
##      57              0 (0.0)       0 (0.0)
##      653             1 (0.0)       1 (0.0)
##      172             1 (0.0)       1 (0.0)
##      15              0 (0.0)       0 (0.0)
##      17              0 (0.0)       0 (0.0)
##      45              0 (0.0)       0 (0.0)
##      103             0 (0.0)       0 (0.0)
##      169             0 (0.0)       0 (0.0)
##      13              0 (0.0)       0 (0.0)
##      22              1 (0.0)       1 (0.0)
##      24              0 (0.0)       0 (0.0)
##      81              2 (0.1)       2 (0.1)
##      146             0 (0.0)       0 (0.0)
##      201             0 (0.0)       0 (0.0)
##      108             0 (0.0)       1 (0.0)
##      107             0 (0.0)       0 (0.0)
##      46              0 (0.0)       0 (0.0)
##      118             0 (0.0)       0 (0.0)
##      141             2 (0.1)       5 (0.2)
##      177             0 (0.0)       0 (0.0)
##      113             0 (0.0)       0 (0.0)
##      240             3 (0.1)       5 (0.2)
##      85              0 (0.0)       2 (0.1)
##      156             0 (0.0)       1 (0.0)
##      656             0 (0.0)       1 (0.0)
##      152             0 (0.0)       0 (0.0)
##      170             0 (0.0)       0 (0.0)
##      184             0 (0.0)       0 (0.0)
##      658             0 (0.0)       1 (0.0)
##      222             0 (0.0)       0 (0.0)
##      224             0 (0.0)       0 (0.0)
##      41              0 (0.0)       0 (0.0)
##      219             0 (0.0)       0 (0.0)
##      131             0 (0.0)       0 (0.0)
##      663             0 (0.0)       0 (0.0)
##      242             0 (0.0)       0 (0.0)
##      64              0 (0.0)       0 (0.0)
```

```
##      37              0 (0.0)       0 (0.0)
##      193             0 (0.0)       0 (0.0)
##      63              0 (0.0)       0 (0.0)
##      114             0 (0.0)       0 (0.0)
##      214             0 (0.0)       0 (0.0)
##      226             0 (0.0)       0 (0.0)
##      662             0 (0.0)       0 (0.0)
##      190             0 (0.0)       0 (0.0)
##      223             0 (0.0)       0 (0.0)
##      216             0 (0.0)       0 (0.0)
```

#Outcome metrics

```
dta_run = dta_m %>%
  mutate(logcost_md = log(cost_md+1),
         logcost_er = log(cost_er+1),
         logcost_hosp = log(cost_hosp+1),
         logcost_pcp = log(cost_pcp+1),
         logcost_spec = log(cost_spec+1),
         logcost_mh = log(cost_mh+1),
         logcost_pt = log(cost_pt+1),
         logcost_rx = log(cost_rx+1),
         logcost_drugadmin = log(cost_drugadmin + 1),
         logcost_surg = log(cost_surg+1),
         logcost_maternity = log(cost_maternity+1),
         logcost_labs = log(cost_labs+1),
         logcost_rads = log(cost_rads +1),
        logcount_er = log(count_er+1),
        logcount_hosp = log(count_hosp+1),
        logcount_pcp = log(count_pcp+1),
        logcount_spec = log(count_spec+1),
        logcount_mh = log(count_mh+1),
        logcount_pt = log(count_pt+1),
        logcount_drugadmin = log(count_drugadmin+1),
        logcount_surg = log(count_surg+1),
        logcount_maternity = log(count_maternity+1),
        logcount_labs = log(count_labs+1),
        logcount_rads = log(count_rads+1),
        cost_per_er = log((cost_er+1)/(count_er+1)),
        cost_per_hosp = log((cost_hosp+1)/(count_hosp+1)),
        cost_per_pcp = log((cost_pcp+1)/(count_pcp+1)),
        cost_per_spec = log((cost_spec+1)/(count_spec+1)),
        cost_per_mh = log((cost_mh+1)/(count_mh+1)),
        cost_per_pt = log((cost_pt+1)/(count_pt+1)),
        cost_per_drugadmin = log((cost_drugadmin+1)/(count_drugadmin+1)),
        cost_per_surg = log((cost_surg+1)/(count_surg+1)),
        cost_per_maternity = log((cost_maternity +1)/(count_maternity+1)),
        cost_per_labs = log((cost_labs+1)/(count_labs+1)),
        cost_per_rads = log((cost_rads+1)/(count_rads+1))
        )
```

```
# pre-match
prem = spacex_dat_ana %>%
  mutate(count_er = 1000*count_er,
```

```
        count_hosp = 1000*count_hosp,
        count_pcp = 1000*count_pcp,
        count_spec = 1000*count_spec,
        count_mh = 1000*count_mh,
        count_pt = 1000*count_pt,
        count_drugadmin = 1000*count_drugadmin,
        count_surg = 1000*count_surg,
        count_maternity = 1000*count_maternity,
        count_labs = 1000*count_labs,
        count_rads = 1000*count_rads
  )
print(CreateTableOne(data =prem, vars = c("age", "female", "hcc", "mm", "cost_md", "cost_rx", "cost_er"
```

```
##                              Stratified by om_flag
##                               0                  1                  p
##   n                           18887              3080
##   age (mean (SD))             26.031 (15.882)    31.818 (9.239)     <0.001
##   female (mean (SD))          0.431 (0.495)      0.197 (0.398)      <0.001
##   hcc (mean (SD))             0.012 (0.073)      0.008 (0.053)      0.005
##   mm (mean (SD))              27.467 (15.905)    34.445 (13.618)    <0.001
##   cost_md (mean (SD))         581.115 (4319.517) 745.996 (3364.441) 0.043
##   cost_rx (mean (SD))         49.953 (713.439)   61.439 (441.217)   0.386
##   cost_er (mean (SD))         32.062 (202.549)   44.136 (285.902)   0.004
##   cost_hosp (mean (SD))       29.200 (473.603)   22.920 (439.775)   0.491
##   cost_pcp (mean (SD))        18.944 (64.311)    79.230 (532.762)   <0.001
##   cost_spec (mean (SD))       7.686 (32.211)     11.056 (49.816)    <0.001
##   cost_mh (mean (SD))         6.380 (105.119)    17.467 (137.238)   <0.001
##   cost_pt (mean (SD))         6.311 (60.557)     48.683 (235.583)   <0.001
##   cost_drugadmin (mean (SD))  12.051 (230.615)   24.928 (752.002)   0.061
##   cost_surg (mean (SD))       82.768 (1491.766)  49.556 (235.409)   0.218
##   cost_maternity (mean (SD))  26.711 (504.105)   3.185 (36.619)     0.010
##   cost_labs (mean (SD))       12.621 (149.354)   17.847 (77.261)    0.057
##   cost_rads (mean (SD))       14.635 (137.500)   15.618 (85.174)    0.700
##   count_er (mean (SD))        7.819 (37.000)     10.060 (56.463)    0.004
##   count_hosp (mean (SD))      4.491 (36.589)     7.084 (132.961)    0.027
##   count_pcp (mean (SD))       45.524 (119.203)   366.338 (2318.138) <0.001
##   count_spec (mean (SD))      18.711 (52.858)    26.317 (133.778)   <0.001
##   count_mh (mean (SD))        3.703 (27.032)     55.771 (447.526)   <0.001
##   count_pt (mean (SD))        7.374 (75.468)     341.542 (1891.509) <0.001
##   count_drugadmin (mean (SD)) 30.073 (104.282)   49.367 (272.991)   <0.001
##   count_surg (mean (SD))      20.097 (73.220)    27.711 (133.083)   <0.001
##   count_maternity (mean (SD)) 2.142 (21.747)     0.246 (2.972)      <0.001
##   count_labs (mean (SD))      27.040 (83.164)    40.701 (163.911)   <0.001
##   count_rads (mean (SD))      14.656 (48.718)    23.760 (150.820)   <0.001
##   vrt_flag (mean (SD))        0.018 (0.134)      0.278 (0.448)      <0.001
##   cnt_flag (mean (SD))        0.007 (0.085)      0.627 (0.484)      <0.001
##                              Stratified by om_flag
##                               test SMD
##   n
##   age (mean (SD))                  0.445
##   female (mean (SD))               0.522
##   hcc (mean (SD))                  0.061
##   mm (mean (SD))                   0.471
```

```
##   cost_md (mean (SD))              0.043
##   cost_rx (mean (SD))              0.019
##   cost_er (mean (SD))              0.049
##   cost_hosp (mean (SD))            0.014
##   cost_pcp (mean (SD))             0.159
##   cost_spec (mean (SD))            0.080
##   cost_mh (mean (SD))              0.091
##   cost_pt (mean (SD))              0.246
##   cost_drugadmin (mean (SD))       0.023
##   cost_surg (mean (SD))            0.031
##   cost_maternity (mean (SD))       0.066
##   cost_labs (mean (SD))            0.044
##   cost_rads (mean (SD))            0.009
##   count_er (mean (SD))             0.047
##   count_hosp (mean (SD))           0.027
##   count_pcp (mean (SD))            0.195
##   count_spec (mean (SD))           0.075
##   count_mh (mean (SD))             0.164
##   count_pt (mean (SD))             0.250
##   count_drugadmin (mean (SD))      0.093
##   count_surg (mean (SD))           0.071
##   count_maternity (mean (SD))      0.122
##   count_labs (mean (SD))           0.105
##   count_rads (mean (SD))           0.081
##   vrt_flag (mean (SD))             0.785
##   cnt_flag (mean (SD))             1.784
```

```
summary(prem)
```

```
##    personid.x           mm               age            female
##  Min.   :182259   Min.   : 0.5484   Min.   : 0.00   Min.   :0.0000
##  1st Qu.:226312   1st Qu.:13.9677   1st Qu.:16.00   1st Qu.:0.0000
##  Median :241713   Median :28.9677   Median :27.50   Median :0.0000
##  Mean   :342188   Mean   :28.4455   Mean   :26.84   Mean   :0.3985
##  3rd Qu.:428072   3rd Qu.:47.9677   3rd Qu.:35.50   3rd Qu.:1.0000
##  Max.   :845685   Max.   :47.9677   Max.   :79.33   Max.   :1.0000
##
##     cost_md            cost_rx            cost_er
##  Min.   :     0.0   Min.   :    0.00   Min.   :   0.00
##  1st Qu.:     0.0   1st Qu.:    0.00   1st Qu.:   0.00
##  Median :    56.4   Median :    0.64   Median :   0.00
##  Mean   :   604.2   Mean   :   51.56   Mean   :  33.76
##  3rd Qu.:   307.1   3rd Qu.:    9.39   3rd Qu.:   0.00
##  Max.   :340677.8   Max.   :83586.29   Max.   :8490.56
##
##    cost_hosp           cost_pcp           cost_spec
##  Min.   :    0.00   Min.   :    0.000   Min.   :   0.000
##  1st Qu.:    0.00   1st Qu.:    0.000   1st Qu.:   0.000
##  Median :    0.00   Median :    5.199   Median :   0.000
##  Mean   :   28.32   Mean   :   27.397   Mean   :   8.158
##  3rd Qu.:    0.00   3rd Qu.:   24.397   3rd Qu.:   6.880
##  Max.   :28593.94   Max.   :13483.698   Max.   :2008.533
##
##     cost_mh            cost_pt           count_er
```

```
##  Min.   :   0.000   Min.   :   0.00   Min.   :   0.000
##  1st Qu.:   0.000   1st Qu.:   0.00   1st Qu.:   0.000
##  Median :   0.000   Median :   0.00   Median :   0.000
##  Mean   :   7.934   Mean   :  12.25   Mean   :   8.133
##  3rd Qu.:   0.000   3rd Qu.:   0.00   3rd Qu.:   0.000
##  Max.   :7718.156   Max.   :5155.26   Max.   :2268.908
##
##    count_hosp         count_pcp          count_spec         count_mh
##  Min.   :   0.000   Min.   :    0.00   Min.   :   0.00   Min.   :    0
##  1st Qu.:   0.000   1st Qu.:    0.00   1st Qu.:   0.00   1st Qu.:    0
##  Median :   0.000   Median :   32.29   Median :   0.00   Median :    0
##  Mean   :   4.855   Mean   :   90.51   Mean   :  19.78   Mean   :   11
##  3rd Qu.:   0.000   3rd Qu.:   66.74   3rd Qu.:  23.27   3rd Qu.:    0
##  Max.   :4573.770   Max.   :65393.03   Max.   :4573.77   Max.   :12338
##
##     count_pt        count_drugadmin   cost_drugadmin       count_surg
##  Min.   :    0.00   Min.   :   0.00   Min.   :    0.00   Min.   :   0.00
##  1st Qu.:    0.00   1st Qu.:   0.00   1st Qu.:    0.00   1st Qu.:   0.00
##  Median :    0.00   Median :   0.00   Median :    0.00   Median :   0.00
##  Mean   :   54.23   Mean   :  32.78   Mean   :   13.86   Mean   :  21.16
##  3rd Qu.:    0.00   3rd Qu.:  41.70   3rd Qu.:    0.87   3rd Qu.:  20.85
##  Max.   :50928.57   Max.   :9147.54   Max.   :39264.82   Max.   :4573.77
##
##    cost_surg          count_maternity    cost_maternity
##  Min.   :     0.00   Min.   :   0.000   Min.   :    0.00
##  1st Qu.:     0.00   1st Qu.:   0.000   1st Qu.:    0.00
##  Median :     0.00   Median :   0.000   Median :    0.00
##  Mean   :    78.11   Mean   :   1.877   Mean   :   23.41
##  3rd Qu.:     1.05   3rd Qu.:   0.000   3rd Qu.:    0.00
##  Max.   :156868.07   Max.   :1476.190   Max.   :36858.13
##
##    count_labs         cost_labs           count_rads
##  Min.   :   0.00   Min.   :    0.000   Min.   :   0.00
##  1st Qu.:   0.00   1st Qu.:    0.000   1st Qu.:   0.00
##  Median :   0.00   Median :    0.000   Median :   0.00
##  Mean   :  28.96   Mean   :   13.354   Mean   :  15.93
##  3rd Qu.:  33.44   3rd Qu.:    6.281   3rd Qu.:  20.85
##  Max.   :6065.22   Max.   :17678.204   Max.   :4573.77
##
##    cost_rads            vrt_flag          cnt_flag          om_flag
##  Min.   :   0.000   Min.   :0.00000   Min.   :0.00000   Min.   :0.0000
##  1st Qu.:   0.000   1st Qu.:0.00000   1st Qu.:0.00000   1st Qu.:0.0000
##  Median :   0.000   Median :0.00000   Median :0.00000   Median :0.0000
##  Mean   :  14.773   Mean   :0.05486   Mean   :0.09405   Mean   :0.1402
##  3rd Qu.:   2.126   3rd Qu.:0.00000   3rd Qu.:0.00000   3rd Qu.:0.0000
##  Max.   :8152.876   Max.   :1.00000   Max.   :1.00000   Max.   :1.0000
##
##       hcc                ccs          diag1
##  Min.   :0.00000   0      :7966   Length:21967
##  1st Qu.:0.00000   256    :3707   Class :character
##  Median :0.00000   10     :1154   Mode  :character
##  Mean   :0.01151   126    : 704
##  3rd Qu.:0.00000   205    : 524
##  Max.   :2.62500   211    : 393
```

```
##                    (Other):7519
```

```
# post-match
postm = dta_m %>%
  mutate(count_er = 1000*count_er,
         count_hosp = 1000*count_hosp,
         count_pcp = 1000*count_pcp,
         count_spec = 1000*count_spec,
         count_mh = 1000*count_mh,
         count_pt = 1000*count_pt,
         count_drugadmin = 1000*count_drugadmin,
         count_surg = 1000*count_surg,
         count_maternity = 1000*count_maternity,
         count_labs = 1000*count_labs,
         count_rads = 1000*count_rads
  )

print(CreateTableOne(data =postm, vars = c("age", "female", "hcc", "mm", "cost_md", "cost_rx", "cost_er
```

```
##                              Stratified by om_flag
##                               0                  1                  SMD
##   n                           3080               3080
##   age (mean (SD))             33.053 (14.793)    31.818 (9.239)     0.100
##   female (mean (SD))          0.192 (0.394)      0.197 (0.398)      0.011
##   hcc (mean (SD))             0.015 (0.072)      0.008 (0.053)      0.107
##   mm (mean (SD))              33.904 (13.956)    34.445 (13.618)    0.039
##   cost_md (mean (SD))         746.672 (3082.216) 745.996 (3364.441) <0.001
##   cost_rx (mean (SD))         75.670 (535.309)   61.439 (441.217)   0.029
##   cost_er (mean (SD))         48.349 (180.204)   44.136 (285.902)   0.018
##   cost_hosp (mean (SD))       29.539 (397.835)   22.920 (439.775)   0.016
##   cost_pcp (mean (SD))        26.782 (58.065)    79.230 (532.762)   0.138
##   cost_spec (mean (SD))       14.830 (49.752)    11.056 (49.816)    0.076
##   cost_mh (mean (SD))         12.629 (129.824)   17.467 (137.238)   0.036
##   cost_pt (mean (SD))         12.363 (58.988)    48.683 (235.583)   0.212
##   cost_drugadmin (mean (SD))  8.288 (74.176)     24.928 (752.002)   0.031
##   cost_surg (mean (SD))       108.613 (972.184)  49.556 (235.409)   0.083
##   cost_maternity (mean (SD))  21.047 (425.584)   3.185 (36.619)     0.059
##   cost_labs (mean (SD))       15.639 (62.316)    17.847 (77.261)    0.031
##   cost_rads (mean (SD))       19.023 (69.279)    15.618 (85.174)    0.044
##   count_er (mean (SD))        12.358 (36.439)    10.060 (56.463)    0.048
##   count_hosp (mean (SD))      4.406 (23.761)     7.084 (132.961)    0.028
##   count_pcp (mean (SD))       65.316 (112.009)   366.338 (2318.138) 0.183
##   count_spec (mean (SD))      32.289 (57.634)    26.317 (133.778)   0.058
##   count_mh (mean (SD))        7.602 (42.907)     55.771 (447.526)   0.152
##   count_pt (mean (SD))        21.595 (173.954)   341.542 (1891.509) 0.238
##   count_drugadmin (mean (SD)) 42.996 (96.722)    49.367 (272.991)   0.031
##   count_surg (mean (SD))      32.083 (66.669)    27.711 (133.083)   0.042
##   count_maternity (mean (SD)) 0.972 (8.123)      0.246 (2.972)      0.119
##   count_labs (mean (SD))      38.004 (60.762)    40.701 (163.911)   0.022
##   count_rads (mean (SD))      25.746 (57.737)    23.760 (150.820)   0.017
##   vrt_flag (mean (SD))        0.036 (0.186)      0.278 (0.448)      0.706
##   cnt_flag (mean (SD))        0.029 (0.168)      0.627 (0.484)      1.651
```

```r
summary(postm)
```

```
##    personid.x           mm               age            female
##  Min.   :205337   Min.   : 0.5806   Min.   : 0.00   Min.   :0.0000
##  1st Qu.:225114   1st Qu.:22.9677   1st Qu.:26.00   1st Qu.:0.0000
##  Median :230178   Median :37.1786   Median :30.80   Median :0.0000
##  Mean   :298721   Mean   :34.1748   Mean   :32.44   Mean   :0.1945
##  3rd Qu.:343572   3rd Qu.:47.9677   3rd Qu.:38.31   3rd Qu.:0.0000
##  Max.   :840243   Max.   :47.9677   Max.   :76.00   Max.   :1.0000
##
##     cost_md            cost_rx             cost_er
##  Min.   :    0.00   Min.   :    0.000   Min.   :   0.00
##  1st Qu.:   53.75   1st Qu.:    0.316   1st Qu.:   0.00
##  Median :  170.93   Median :    3.345   Median :   0.00
##  Mean   :  746.33   Mean   :   68.555   Mean   :  46.24
##  3rd Qu.:  514.09   3rd Qu.:   18.902   3rd Qu.:   0.00
##  Max.   :94956.37   Max.   :21265.647   Max.   :8490.56
##
##    cost_hosp           cost_pcp           cost_spec
##  Min.   :    0.00   Min.   :    0.000   Min.   :   0.000
##  1st Qu.:    0.00   1st Qu.:    3.339   1st Qu.:   0.000
##  Median :    0.00   Median :   15.592   Median :   3.656
##  Mean   :   26.23   Mean   :   53.006   Mean   :  12.943
##  3rd Qu.:    0.00   3rd Qu.:   39.327   3rd Qu.:  12.236
##  Max.   :17936.51   Max.   :13483.698   Max.   :2008.533
##
##     cost_mh            cost_pt           count_er         count_hosp
##  Min.   :   0.00   Min.   :   0.00   Min.   :   0.00   Min.   :   0.000
##  1st Qu.:   0.00   1st Qu.:   0.00   1st Qu.:   0.00   1st Qu.:   0.000
##  Median :   0.00   Median :   0.00   Median :   0.00   Median :   0.000
##  Mean   :  15.05   Mean   :  30.52   Mean   :  11.21   Mean   :   5.745
##  3rd Qu.:   0.00   3rd Qu.:  12.51   3rd Qu.:   0.00   3rd Qu.:   0.000
##  Max.   :5023.03   Max.   :5092.86   Max.   :1476.19   Max.   :4573.770
##
##    count_pcp          count_spec         count_mh
##  Min.   :    0.00   Min.   :   0.00   Min.   :    0.00
##  1st Qu.:   34.52   1st Qu.:   0.00   1st Qu.:    0.00
##  Median :   57.20   Median :  20.85   Median :    0.00
##  Mean   :  215.83   Mean   :  29.30   Mean   :   31.69
##  3rd Qu.:  145.93   3rd Qu.:  30.75   3rd Qu.:    0.00
##  Max.   :65393.03   Max.   :4573.77   Max.   :12338.31
##
##     count_pt        count_drugadmin   cost_drugadmin       count_surg
##  Min.   :    0.00   Min.   :   0.00   Min.   :    0.00   Min.   :   0.00
##  1st Qu.:    0.00   1st Qu.:   0.00   1st Qu.:    0.00   1st Qu.:   0.00
##  Median :    0.00   Median :   0.00   Median :    0.00   Median :   0.00
##  Mean   :  181.57   Mean   :  46.18   Mean   :   16.61   Mean   :  29.90
##  3rd Qu.:   35.76   3rd Qu.:  52.68   3rd Qu.:    1.09   3rd Qu.:  34.52
##  Max.   :50928.57   Max.   :9147.54   Max.   :39264.82   Max.   :4573.77
##
##    cost_surg        count_maternity    cost_maternity
##  Min.   :    0.00   Min.   :  0.0000   Min.   :    0.00
##  1st Qu.:    0.00   1st Qu.:  0.0000   1st Qu.:    0.00
```

```
##  Median :    0.00   Median :  0.0000   Median :    0.00
##  Mean   :   79.08   Mean   :  0.6086   Mean   :   12.12
##  3rd Qu.:    8.04   3rd Qu.:  0.0000   3rd Qu.:    0.00
##  Max.   :38821.15   Max.   :164.8936   Max.   :17796.10
##
##    count_labs        cost_labs          count_rads        cost_rads
##  Min.   :   0.00   Min.   :   0.000   Min.   :   0.00   Min.   :   0.000
##  1st Qu.:   0.00   1st Qu.:   0.000   1st Qu.:   0.00   1st Qu.:   0.000
##  Median :  22.24   Median :   3.699   Median :  20.85   Median :   0.000
##  Mean   :  39.35   Mean   :  16.743   Mean   :  24.75   Mean   :  17.321
##  3rd Qu.:  41.70   3rd Qu.:  11.484   3rd Qu.:  25.66   3rd Qu.:   8.208
##  Max.   :4573.77   Max.   :2530.144   Max.   :4573.77   Max.   :3194.151
##
##     vrt_flag         cnt_flag         om_flag         hcc
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.0   Min.   :0.00000
##  1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:0.0   1st Qu.:0.00000
##  Median :0.0000   Median :0.0000   Median :0.5   Median :0.00000
##  Mean   :0.1571   Mean   :0.3278   Mean   :0.5   Mean   :0.01152
##  3rd Qu.:0.0000   3rd Qu.:1.0000   3rd Qu.:1.0   3rd Qu.:0.00000
##  Max.   :1.0000   Max.   :1.0000   Max.   :1.0   Max.   :0.73500
##
##       ccs          diag1            hcccat           distance
##  256    :1134   Length:6160        Mode:logical   Min.   :0.009827
##  10     : 679   Class :character   TRUE:6160      1st Qu.:0.221182
##  205    : 374   Mode  :character                  Median :0.315969
##  126    : 337                                     Mean   :0.331153
##  211    : 323                                     3rd Qu.:0.440231
##  204    : 297                                     Max.   :1.000000
##  (Other):3016
##     weights
##  Min.   :1
##  1st Qu.:1
##  Median :1
##  Mean   :1
##  3rd Qu.:1
##  Max.   :1
##
```

#Treatment effect

```
glmMatched1 <- glm(formula = logcost_md ~ om_flag + age + female + mm + hcc + ccs ,
                   data    = dta_run)

glmMatched2 <- glm(formula = logcost_er ~ om_flag + age + female + mm + hcc + ccs ,
                   data    = dta_run)

glmMatched3 <- glm(formula = logcost_hosp ~ om_flag + age + female + mm + hcc + ccs ,
                   data    = dta_run)

glmMatched4 <- glm(formula = logcost_pcp ~ om_flag + age + female + mm + hcc + ccs ,
                   data    = dta_run)

glmMatched5 <- glm(formula = logcost_spec ~ om_flag + age + female + mm + hcc + ccs ,
                   data    = dta_run)
```

```
glmMatched5a <- glm(formula = logcost_mh ~ om_flag + age + female + mm + hcc + ccs ,
                    data    = dta_run)


glmMatched5b <- glm(formula = logcost_pt ~ om_flag + age + female + mm + hcc + ccs ,
                    data    = dta_run)


glmMatched6 <- glm(formula = logcost_rx ~ om_flag + age + female + mm + hcc + ccs ,
                   data    = dta_run)


glmMatched6a <- glm(formula = logcost_drugadmin ~ om_flag + age + female + mm + hcc + ccs ,
                    data    = dta_run)
glmMatched6b <- glm(formula = logcost_surg ~ om_flag + age + female + mm + hcc + ccs ,
                    data    = dta_run)
glmMatched6c <- glm(formula = logcost_maternity ~ om_flag + age + female + mm + hcc + ccs ,
                    data    = dta_run)
glmMatched6d <- glm(formula = logcost_labs ~ om_flag + age + female + mm + hcc + ccs ,
                    data    = dta_run)
glmMatched6e <- glm(formula = logcost_rads ~ om_flag + age + female + mm + hcc + ccs ,
                    data    = dta_run)


glmMatched7 <- glm(formula = logcount_er ~ om_flag + age + female + mm + hcc + ccs ,
                   data    = dta_run)


glmMatched8 <- glm(formula = logcount_hosp ~ om_flag + age + female + mm + hcc + ccs ,
                   data    = dta_run)


glmMatched9 <- glm(formula = logcount_pcp ~ om_flag + age + female + mm + hcc + ccs ,
                   data    = dta_run)

glmMatched10 <- glm(formula = logcount_spec ~ om_flag + age + female + mm + hcc + ccs ,
                    data    = dta_run)



glmMatched10a <- glm(formula = logcount_mh ~ om_flag + age + female + mm + hcc + ccs ,
                     data    = dta_run)



glmMatched10b <- glm(formula = logcount_pt ~ om_flag + age + female + mm + hcc + ccs ,
                     data    = dta_run)


glmMatched10c <- glm(formula = logcount_drugadmin ~ om_flag + age + female + mm + hcc + ccs ,
                     data    = dta_run)
glmMatched10d <- glm(formula = logcount_surg ~ om_flag + age + female + mm + hcc + ccs ,
```

```
                    data    = dta_run)
glmMatched10e <- glm(formula = logcount_maternity ~ om_flag + age + female + mm + hcc + ccs ,
                    data    = dta_run)
glmMatched10f <- glm(formula = logcount_labs ~ om_flag + age + female + mm + hcc + ccs ,
                    data    = dta_run)
glmMatched10g <- glm(formula = logcount_rads ~ om_flag + age + female + mm + hcc + ccs ,
                    data    = dta_run)


glmMatched11 <- glm(formula = cost_per_er ~ om_flag + age + female + mm + hcc + ccs ,
                   data    = dta_run)

glmMatched11b <- glm(formula = cost_per_hosp ~ om_flag + age + female + mm + hcc + ccs ,
                   data    = dta_run)

glmMatched11c <- glm(formula = cost_per_pcp ~ om_flag + age + female + mm + hcc + ccs ,
                   data    = dta_run)


glmMatched5c <- glm(formula = cost_per_spec ~ om_flag + age + female + mm + hcc + ccs ,
                   data    = dta_run)


glmMatched5ca <- glm(formula = cost_per_mh ~ om_flag + age + female + mm + hcc + ccs ,
                    data    = dta_run)


glmMatched5cb <- glm(formula = cost_per_pt ~ om_flag + age + female + mm + hcc + ccs ,
                    data    = dta_run)



glmMatched5cc <- glm(formula = cost_per_drugadmin ~ om_flag + age + female + mm + hcc + ccs ,
                    data    = dta_run)

glmMatched5cd <- glm(formula = cost_per_surg ~ om_flag + age + female + mm + hcc + ccs ,
                    data    = dta_run)

glmMatched5ce <- glm(formula = cost_per_maternity ~ om_flag + age + female + mm + hcc + ccs ,
                    data    = dta_run)

glmMatched5cf <- glm(formula = cost_per_labs ~ om_flag + age + female + mm + hcc + ccs ,
                    data    = dta_run)

glmMatched5cg <- glm(formula = cost_per_rads ~ om_flag + age + female + mm + hcc + ccs ,
                    data    = dta_run)
```

##Results as percentage change in each outcome

```
exponentiate <- function(x) ((exp(x)-1)*100)

stargazer::stargazer(glmMatched1, glmMatched2, glmMatched3, glmMatched4, glmMatched5, glmMatched5a, glmM
          title="Spending",
```

```
          type = "text",
          keep=c("om_flag"),
          ci=TRUE, ci.level=0.95,
          apply.coef=exponentiate, apply.se = exponentiate,
          digits = 1,
          star.cutoffs = c(0.05, 0.01, 0.001),
          column.labels = c("Total Spend", "Emergency", "Hospital", "Primary Care", "Specialist", "Menta
          out = "table1.txt")
```

```
##
## Spending
## ================================================================================================
##
##                   ------------------------------------------------------------------------------
##                    logcost_md     logcost_er   logcost_hosp  logcost_pcp   logcost_spec   logcost_mh
##                    Total Spend    Emergency      Hospital    Primary Care   Specialist   Mental Healt
##                        (1)           (2)            (3)          (4)           (5)            (6)
## ------------------------------------------------------------------------------------------------
## om_flag              -17.3***       -32.3***       -9.6***       10.9*        -36.6***       11.7***
##                   (-26.3, -8.3) (-42.1, -22.5) (-14.6, -4.5) (2.5, 19.3)  (-43.6, -29.6)  (5.7, 17.6)
##
## ------------------------------------------------------------------------------------------------
## Observations          6,160         6,160          6,160         6,160         6,160          6,160
## Log Likelihood      -12,096.5     -12,629.4      -8,604.7     -11,688.2     -10,608.1      -9,618.1
## Akaike Inf. Crit.   24,467.1       25,532.7      17,483.4      23,650.5      21,490.3      19,510.1
## ================================================================================================
## Note:
```

```
stargazer::stargazer(glmMatched7, glmMatched8, glmMatched9, glmMatched10, glmMatched10a, glmMatched10b,g
          title="Utilization",
          type = "text",
          keep=c("om_flag"),
          ci=TRUE, ci.level=0.95,
          apply.coef=exponentiate,apply.se = exponentiate,
          digits = 1,
          star.cutoffs = c(0.05, 0.01, 0.001),
          column.labels = c("Emergency", "Hospital", "Primary Care", "Specialist", "Mental Health", "Phy
          out = "table2.txt")
```

```
##
## Utilization
## ================================================================================================
##                                                                                  Dependent v
##                   ------------------------------------------------------------------------------
##                   logcount_er  logcount_hosp logcount_pcp logcount_spec  logcount_mh    logcount_pt
##                    Emergency     Hospital    Primary Care   Specialist   Mental Health Physical Therap
##                        (1)           (2)           (3)           (4)           (5)            (6)
## ------------------------------------------------------------------------------------------------
## om_flag               -0.2**         0.05         14.9***       -0.7***       2.4***         15.7***
##                   (-0.4, -0.1)  (-0.2, 0.3)  (13.8, 16.0) (-1.0, -0.4)   (1.9, 2.9)     (14.5, 17.0)
##
## ------------------------------------------------------------------------------------------------
## Observations          6,160         6,160         6,160         6,160         6,160          6,160
```

```
## Log Likelihood      11,829.3     10,915.1       758.7        9,205.1       5,266.5         -158.4
## Akaike Inf. Crit.  -23,384.5     -21,556.3     -1,243.5     -18,136.3     -10,259.0        590.9
## ================================================================================================
## Note:
```

```
stargazer::stargazer(glmMatched11, glmMatched11b, glmMatched11c, glmMatched5c, glmMatched5ca, glmMatche
          title="Cost per Utilization",
          type = "text",
          keep=c("om_flag"),
          ci=TRUE, ci.level=0.95,
          apply.coef=exponentiate,apply.se = exponentiate,
          digits = 1,
          star.cutoffs = c(0.05, 0.01, 0.001),
          column.labels = c("Emergency", "Hospital", "Primary Care", "Specialist", "Mental Health", "Ph
          out = "table3.txt")
```

```
##
## Cost per Utilization
## ================================================================================================
##                                                                                      Depende
##                    ---------------------------------------------------------------------------
##                     cost_per_er   cost_per_hosp cost_per_pcp cost_per_spec   cost_per_mh    cost_per_
##                       Emergency      Hospital    Primary Care   Specialist   Mental Health Physical Th
##                          (1)            (2)          (3)           (4)           (5)            (6)
## ------------------------------------------------------------------------------------------------
## om_flag                -32.1***       -9.6***        -3.5        -36.1***        9.0**         115.5**
##                     (-41.8, -22.4) (-14.6, -4.7) (-11.3, 4.2) (-43.0, -29.3)  (3.3, 14.7)   (107.5, 12
##
## ------------------------------------------------------------------------------------------------
## Observations           6,160          6,160         6,160         6,160          6,160          6,160
## Log Likelihood      -12,557.4      -8,485.1      -11,225.7     -10,475.4      -9,326.3       -11,397.
## Akaike Inf. Crit.    25,388.9      17,244.2       22,725.4      21,224.8       18,926.7       23,068.
## ================================================================================================
## Note:
```

```
save.image("~/Box/Analytics Team/Research/Research projects/One medical/onemedical.RData")
```