notes for hcup analysis

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Contents

```r
library(data.table)
library(icd9)
library(survey)
options(survey.lonely.psu = "adjust")
library(ggplot2)
# library(medicalrisk)
library(xtable)
# library(stargazer)
library(plyr)

# to take advantage of multicore=T option in survey
library(parallel)
detectCores()
# cl <- makeCluster(7) registerDoParallel(cl)
# getDoParWorkers()

# system.time(inj<-saveRDS(inj,'~/nis.00_11.inj.rds'))
# system.time(inj<-readRDS('~/nis.00_11.inj.rds'))
```

1 initial analyses

1.1 descriptives, rates and ratios

Weights add up to 18,720,487 trauma admissions over the 12 year period, 2000 to 2011. Survey procedure returns 18,720,487 (se = 414017). Proportion of male and female admissions was approximately evenly split, with 50.2 % female (sd = .4%).

Increase in the mean age of trauma inpatients over the study period. (Table 1, Figure 1) Simple linear regression, linear term for the effect of year on age statistically significant (β = 0.43, se=0.066, p $<$ 0.0001)

Average yearly rate of injury admissions in the United States during the study period was 524.3 admissions per 100,000 population (95% CI 483.3, 505.4). Indication of a decline in annual injury admission rates during the study period (Figure 2); decline was not statistically significant (β for effect of year on injury rate -1.67, s.e.=1.76, p=0.364)

Average yearly rates of injury admissions vary by census regions (Figure 3). Interaction term for census region by year statistically significant for a higher trend over the study period for the South (β = 14.5, se=3.8, p $<$ 0.0005) and West (β = 11.1, se=3.8, p = 0.0006) census regions. (Table 2)

Population-based rates of injury and trauma admissions for children and younger adults declined. (Figure 4) Population-based admission rates for older adults (Figure 5 and Figure 6) constant. The only group that experienced increasing rates of injury admissions are those ages 45 to 64. (Figure 4)

451,058 (se = 14693) total inpatient deaths due to injury during the study period. The overall case-fatality rate during the 12 years was 0.024 (s.e. = 0.0004). (Tables 4 and 5)

```
sum(inj$DISCWT)  # 18,720,487



table(inj$DIED)  # 91,936

91936 * 5

459680/12

# create survey object
injsvy <- svydesign(id = ~HOSPID, strata = ~NIS_STRATUM, weights = ~DISCWT,
    nest = TRUE, data = inj)


inj$count <- 1

svytotal(~count, injsvy)

# total SE count 18720487 414017


svymean(~FEMALE, injsvy, na.rm = T)


injAdmit_yr <- svytable(~count + YEAR, injsvy)
# pops from MS2014-02 Population Denominator Data Tables
natPop <- c(311582564, 309326295, 306771529, 304093966, 301231207,
    298379912, 295516599, 292805298, 290107933, 287625193, 284968955,
    282162411)
natPop <- natPop[12:1]
natRate <- data.frame(Rate = injAdmit_yr[1:12]/natPop * 1e+05,
    Year = 2000:2011)
natRate

p1 <- ggplot(data = natRate, aes(x = Year, y = Rate))
p2 <- p1 + geom_line(aes(greopu = 1)) + ylim(0, 600) + xlim(2000,
    2011) + geom_smooth(aes(group = 1), size = 1.5)
p3 <- p2 + ylab("Injury Admission Rate per 100,000 Population") +
    theme_bw() + scale_x_continuous(breaks = seq(2000, 2011,
    1))
natRatePlot <- p3
ggsave(file = "~/natRatePlot.jpg", natRatePlot)
```

```r
mean(natRate$Rate)
mean(natRate$Rate) - (1.96 * sd(natRate$Rate))
mean(natRate$Rate) + (1.96 * sd(natRate$Rate))
natRateReg <- lm(Rate ~ Year, data = natRate)
summary(natRateReg)

# stratify rates by census region

# NB: HOSP_REGION is missing from the dataset, but HOSPST is
# available, will define cenus region variable using state
# abreviations as per census website: Northeast: Connecticut,
# Maine, Massachusetts, New Hampshire, Rhode Island, Vermont,
# New Jersey, New York, and Pennsylvania.  Midwest: Illinois,
# Indiana, Michigan, Ohio, and Wisconsin, Iowa, Kansas,
# Minnesota, Missouri, Nebraska, North Dakota, and South
# Dakota.  South : Delaware, District of Columbia, Florida,
# Georgia, Maryland, North Carolina, South Carolina,
# Virginia, West Virginia, Alabama, Kentucky, Mississippi,
# and Tennessee, Arkansas, Louisiana, Oklahoma, and Texas.
# West: Arizona, Colorado, Idaho, Montana, Nevada, New
# Mexico, Utah, and Wyoming, Alaska, California, Hawaii,
# Oregon, and Washington.


# state info available in the datasets::state dataset
str(state)
regions <- tapply(state.abb, state.region, print)

regions
regions$Northeast
regions$South
regions$West
regions$`North Central`

inj$region[inj$HOSPST %in% regions$Northeast] <- "Northeast"
inj$region[inj$HOSPST %in% regions$South] <- "South"
inj$region[inj$HOSPST %in% regions$West] <- "West"
inj$region[inj$HOSPST %in% regions$`North Central`] <- "Midwest"

table(inj$region)

injAdmit_yrXregion <- svytable(~count + YEAR + region, injsvy)
str(injAdmit_yrXregion)

# pops from MS2014-02 Population Denominator Data Tables -
# Appendix A 08152014.xlsx
ne.pop <- c(55598499, 55361036, 55133101, 54875926, 54653362,
```

```
    54522659, 54451230, 54423533, 54334453, 54143915, 53915522,
    53666295)
mw.pop <- c(67146663, 66975848, 66748437, 66523935, 66293689,
    66028555, 65751872, 65532305, 65276954, 65018293, 64776531,
    64491431)
s.pop <- c(116032322, 114865724, 113548615, 112184930, 110688742,
    109076933, 107479771, 105883977, 104380188, 103150787, 101849575,
    100565549)
w.pop <- c(72805080, 72147081, 71341376, 70509175, 69595414,
    68751765, 67833726, 66965483, 66116338, 65312198, 64427327,
    63439136)

regRate <- data.frame(Injury = c(injAdmit_yrXregion[1, 1:12,
    1], injAdmit_yrXregion[1, 1:12, 2], injAdmit_yrXregion[1,
    1:12, 3], injAdmit_yrXregion[1, 1:12, 4]), Population = c(mw.pop,
    ne.pop, s.pop, w.pop), Year = rep(2000:2011, 4), Region = c(rep("Midwest",
    12), rep("Northeast", 12), rep("South", 12), rep("West",
    12)))

regRate$Rate <- regRate$Injury/regRate$Population * 1e+05

regRate

p1 <- ggplot(data = regRate, aes(x = Year, y = Rate))
p2 <- p1 + geom_line(aes(group = 1)) + ylim(0, 800) + xlim(2000,
    2011) + geom_smooth(aes(group = 1), size = 1.5) + facet_wrap(~Region)
p3 <- p2 + ylab("Injury Admssion Rate per 100,000 Population") +
    theme_bw() + scale_x_continuous(breaks = seq(2000, 2011,
    2))
regRatePlot <- p3

regRatePlot
ggsave(file = "~/regRatePlot.jpg", regRatePlot)
tapply(regRate$Rate, regRate$Region, mean)
tapply(regRate$Rate, regRate$Region, sd)

regRateReg <- lm(Rate ~ Year + Region + Year:Region, data = regRate)
summary(regRateReg)
stargazer(regRateReg)

# stratify rates by agegroup

# pops from MS2014-02 Population Denominator Data Tables -
# Appendix A 08152014.xlsx
LT18.pop <- c(73902222, 74195760, 74134167, 74104602, 74019405,
    73757714, 73523669, 73297735, 73100758, 72936457, 72671175,
    72376189)
```

```
GT17.LT45.pop <- c(113498581, 112936714, 112741499, 112594233,
    112317718, 112241819, 112205731, 112369010, 112314747, 112471003,
    112515926, 112288614)
GT44.LT65.pop <- c(82812248, 81779634, 80272688, 78617510, 77068373,
    75216272, 73137401, 70935234, 68828899, 66695526, 64491563,
    62428040)
GT64.LT85.pop <- c(35656696, 34904825, 34255874, 33581781, 32786166,
    32298178, 31956499, 31657436, 31397353, 31153399, 30977797,
    30807096)
GT84.pop <- c(5712817, 5532756, 5367301, 5195840, 5039545, 4865929,
    4693299, 4545883, 4466176, 4368808, 4312494, 4262472)
LT18.pop <- LT18.pop[12:1]
GT17.LT45.pop <- GT17.LT45.pop[12:1]
GT44.LT65.pop <- GT44.LT65.pop[12:1]
GT64.LT85.pop <- GT64.LT85.pop[12:1]
GT84.pop <- GT84.pop[12:1]

injAdmit_yrXage <- svytable(~count + YEAR + ageGrp, injsvy)
str(injAdmit_yrXage)

ageRate <- data.frame(Injury = c(injAdmit_yrXage[1, 1:12, 1],
    injAdmit_yrXage[1, 1:12, 2], injAdmit_yrXage[1, 1:12, 3],
    injAdmit_yrXage[1, 1:12, 4], injAdmit_yrXage[1, 1:12, 5]),
    Population = c(LT18.pop, GT17.LT45.pop, GT44.LT65.pop, GT64.LT85.pop,
        GT84.pop), Year = rep(2000:2011, 5), `Age Group` = c(rep("0 to 18",
        12), rep("18 to 44", 12), rep("45 to 64", 12), rep("65 to 84",
        12), rep("Over 84", 12)))

ageRate$Rate <- ageRate$Injury/ageRate$Population * 1e+05

names(ageRate)

p1 <- ggplot(data = ageRate[ageRate$Age.Group %in% c("0 to 18",
    "18 to 44", "45 to 64"), ], aes(x = Year, y = Rate))
p2 <- p1 + geom_line(aes(group = 1)) + ylim(0, 600) + xlim(2000,
    2011) + geom_smooth(aes(group = 1), size = 1) + facet_wrap(~Age.Group)
p3 <- p2 + ylab("Injury Admssion Rate per 100,000 Population") +
    theme_bw() + scale_x_continuous(breaks = seq(2000, 2011,
    2))
ageRatePlot1 <- p3
ggsave(file = "~/ageRatePlot1.jpg", ageRatePlot1)

p1 <- ggplot(data = ageRate[ageRate$Age.Group == "65 to 84",
    ], aes(x = Year, y = Rate))
p2 <- p1 + geom_line(aes(group = 1)) + ylim(0, 1500) + xlim(2000,
    2011) + geom_smooth(aes(group = 1), size = 1) + facet_wrap(~Age.Group)
p3 <- p2 + ylab("Injury Admssion Rate per 100,000 Population") +
```

```
    theme_bw() + scale_x_continuous(breaks = seq(2000, 2011,
    2))
ageRatePlot2 <- p3
ggsave(file = "~/ageRatePlot2.jpg", ageRatePlot2)

p1 <- ggplot(data = ageRate[ageRate$Age.Group == "Over 84", ],
    aes(x = Year, y = Rate))
p2 <- p1 + geom_line(aes(group = 1)) + ylim(0, 6000) + xlim(2000,
    2011) + geom_smooth(aes(group = 1), size = 1) + facet_wrap(~Age.Group)
p3 <- p2 + ylab("Injury Admssion Rate per 100,000 Population") +
    theme_bw() + scale_x_continuous(breaks = seq(2000, 2011,
    2))
ageRatePlot3 <- p3
ggsave(file = "~/ageRatePlot3.jpg", ageRatePlot3)

svytotal(~DIED, injsvy, na.rm = T)

# simple fatality counts by year
svytable(~DIED + YEAR, injsvy)

# fatality counts by year with s.e.s
svyby(~DIED, ~YEAR, injsvy, svytotal, na.rm = T, keep.var = TRUE)

# overall case fatality
svyratio(~DIED, ~count, injsvy, na.rm = T)

# case fatality by year
svyby(~DIED, by = ~YEAR, denominator = ~count, design = injsvy,
    FUN = svyratio, na.rm = T)

svymean(~AGE, injsvy, na.rm = T)

55.91 + (1.96 * 0.3603)  #56.61619
55.91 - (1.96 * 0.3603)  # 55.20381

# mean age
svyby(~AGE, ~YEAR, injsvy, svymean, na.rm = T, keep.var = TRUE)

# plot change in mean age over time

year <- 2000:2011
avg <- c(54.0761, 55.02758, 54.47841, 54.62286, 53.59526, 55.27371,
    55.51341, 56.29663, 58.07017, 57.98011, 56.34771, 59.58384)
se <- c(0.7137307, 0.7382126, 0.7033017, 0.7641144, 0.7490097,
    0.8139469, 0.7790729, 0.8041648, 0.7577647, 0.704265, 0.7709529,
    0.7873491)
lower <- avg + (1.96 * se)
```

```
upper <- avg - (1.96 * se)

age.dat <- data.frame(avg, lower, upper, year)

# plot mean age with ci's

p1 <- ggplot(data = age.dat, aes(y = avg, ymin = lower, ymax = upper,
    x = year)) + ylim(0, 65) + xlab("Year") + ylab("Mean Age (95% CI)")
p2 <- p1 + geom_linerange(alpha = I(12/12))
p3 <- p2 + geom_point(aes(y = avg, x = year))
p4 <- p3 + geom_hline(yintercept = 55.91, color = "grey", alpha = I(12/12)) +
    geom_hline(yintercept = c(55.2, 56.6), lty = 2, color = "grey",
        alpha = I(8/12))
agePlot1 <- p4
ggsave(file = "~/agePlot1.jpg", agePlot1)

# plot as time series
p1 <- ggplot(data = age.dat, aes(x = year, y = avg))
p2 <- p1 + geom_line(aes(group = 1)) + ylim(0, 80) + xlab("Year") +
    ylab("Mean Age (Confidence Envelope for Trend Line)")
p2 + geom_smooth(aes(group = 1), size = 1.5)

# regress year on age...
ageYrReg <- svyglm(AGE ~ YEAR, design = injsvy)

summary(ageYrReg)
```

Injury admission rates by income quartiles. Quartile data are available for only half the data. Evidence of a recent decrease in the lowest income quartile, but difficult to draw conclusions with few data points.

```
table(inj$ZIPINC_QRTL, inj$YEAR)  # only available from 2006 to 2011
injAdmit_incqtl <- svytable(~count + YEAR + ZIPINC_QRTL, injsvy)

qrtl1.inj <- injAdmit_incqtl[1, 1:6, 1]
qrtl2.inj <- injAdmit_incqtl[1, 1:6, 2]
qrtl3.inj <- injAdmit_incqtl[1, 1:6, 3]
qrtl4.inj <- injAdmit_incqtl[1, 1:6, 4]

qrtl1.pop <- c(72187525, 76325391, 69666556, 74925781, 70808587,
    57158832)
qrtl2.pop <- c(73182174, 73177943, 73561118, 67593085, 72417821,
    74301400)
qrtl3.pop <- c(75677281, 68748487, 76467187, 74521815, 70933564,
    65832686)
qrtl4.pop <- c(74049312, 74636169, 70931699, 69702035, 69738298,
    83399297)
```

```
qrtl1.pop <- qrtl1.pop[6:1]
qrtl2.pop <- qrtl2.pop[6:1]
qrtl3.pop <- qrtl3.pop[6:1]
qrtl4.pop <- qrtl4.pop[6:1]

incDat <- data.frame(Injury = c(qrtl1.inj, qrtl2.inj, qrtl3.inj,
    qrtl4.inj), Population = c(qrtl1.pop, qrtl2.pop, qrtl3.pop,
    qrtl4.pop), Quartile = c(rep("Income Quartile 1", 6), rep("Income Quartile 2",
    6), rep("Income Quartile 3", 6), rep("Income Quartile 4",
    6)), Year = rep(2006:2011, 4))

incDat$Rate <- incDat$Injury/incDat$Population * 1e+05

p1 <- ggplot(data = incDat, aes(x = Year, y = Rate))
p2 <- p1 + geom_line(aes(group = 1)) + ylim(0, 1000) + xlim(2006,
    2011) + geom_smooth(aes(group = 1), size = 1.5) + facet_wrap(~Quartile)
p3 <- p2 + ylab("Injury Admission Rate per 100,000 Population") +
    theme_bw() + scale_x_continuous(breaks = seq(2006, 2011,
    1))
incPlot1 <- p3
ggsave(file = "~/incPlot1.jpg", incPlot1)
```

1.2 iciss

Mean ICISS for the entire study period was 0.94 (se=0.0011 95% CI, .940, 0..945). Apparent decrease in ICISS in the mean ICISS indicating more severe injuries over time. Simple linear regression, term for the effect of year on ICISS small, but statistically significant (β = -0.0008, s.e.= 0.0002, p $<$ 0.0001) (Table 6 , Figure 8)

ICISS not normally distributed. Quantiles with CI's as alternative, also highly skewed(0.94, 0.97, 0.98). Transformations (log and square root) similarly problematic.

Dichotomize into severe vs. less severe injures using cut off of 0.941 [1] Overall proportion of admitted injuries classified as severe during the study period 25.9% (95% CI 24.8, 26.9). Proportion of admitted injuries classified as severe increased annually over the study period (Table 7 , Figure 10)

All regions of the United States an increase in the proportion of trauma and injury admissions to US hospitals from 2000 to 2011 classified as severe. (Figure 11) South appears to have had more years with a greater than average proportion of severe injuries; regression analysis did not show a statistically significant difference among regions. (Table 8)

Proportion of injuries classified as severe was highest among the lowest income quartile

[1] see Gedeborg "Injury incidence over time based on hospital admissions", http://www.cdc.gov/nchs/injury/ice/boston2009/boston2009_proceedings.htm#proceeding_20

(28.9%, se 0.01, Table 12) Differences among the income quartiles were statistically significant (p=0.0216, Table 13)

Age group with the highest proportion of severe injuries was the 18-to-44 year-old group. (37%, se = 0.01, Table 11) The differences among age groups was statistically significant (Table 10). All age groups experienced an increase in the proportion of severe injuries over the study period. (Figure 12)

```
injsvy <- svydesign(id = ~HOSPID, strata = ~NIS_STRATUM, weights = ~DISCWT,
    nest = TRUE, data = inj)

svymean(~iciss, injsvy, na.rm = T)



0.94257 + (1.96 * 0.0011)
0.94257 - (1.96 * 0.0011)

# mean iciss by year
svyby(~iciss, ~YEAR, injsvy, svymean, na.rm = T, keep.var = TRUE,
    multicore = T)

icissYrReg <- svyglm(iciss ~ YEAR, design = injsvy)

summary(icissYrReg)

# plot change in iciss age over time

year <- 2000:2011
avg <- c(0.947828, 0.9480227, 0.945511, 0.9438232, 0.9393488,
    0.9442602, 0.9413681, 0.9418476, 0.9422426, 0.9415619, 0.9343893,
    0.9416682)
se <- c(0.001715785, 0.001924427, 0.001895553, 0.002099298, 0.002424924,
    0.001850744, 0.001944955, 0.002222391, 0.002196456, 0.001874487,
    0.002001613, 0.002119881)
lower <- avg + (1.96 * se)
upper <- avg - (1.96 * se)

iciss.dat <- data.frame(avg, lower, upper, year)

# plot mean age with ci's

p1 <- ggplot(data = iciss.dat, aes(y = avg, ymin = lower, ymax = upper,
    x = year)) + ylim(0.85, 1) + xlab("Year") + ylab("Mean ICISS (95% CI)")
p2 <- p1 + geom_linerange(alpha = I(12/12))
p3 <- p2 + geom_point(aes(y = avg, x = year))
p4 <- p3 + geom_hline(yintercept = mean(avg), color = "grey",
    alpha = I(12/12)) + geom_hline(yintercept = c(mean(avg) -
    (1.09 * sqrt(var(avg))), mean(avg) + (1.09 * sqrt(var(avg)))),
```

```
    lty = 2, color = "grey", alpha = I(8/12))
icissPlot1 <- p4
ggsave(file = "~/icissPlot1.jpg", icissPlot1)

plot(table(inj$iciss))

svyquantile(~iciss, injsvy, c(0.25, 0.5, 0.75), ci = TRUE, multicore = T)

summary(inj$iciss)
summary(sqrt(inj$iciss))

inj$severe <- 0
inj$severe[inj$iciss < 0.941] <- 1

mean(inj$severe)
sd(inj$severe)

svymean(~severe, injsvy, multicore = T)
0.25883 - (1.96 * 0.0054)
0.25883 + (1.96 * 0.0054)


# mean severe
natSevere <- svyby(~severe, ~YEAR, injsvy, svymean, na.rm = T,
    keep.var = TRUE, multicore = T)
natSevere

natSevere$upper <- natSevere$severe + (1.96 * natSevere$se)
natSevere$lower <- natSevere$severe - (1.96 * natSevere$se)

# plot mean severe with ci's

p1 <- ggplot(data = natSevere, aes(y = severe, ymin = lower,
    ymax = upper, x = YEAR)) + ylim(0, 0.4) + xlab("Year") +
    ylab("Proportion Admissions with Severe Injuries (95% CI)")
p2 <- p1 + geom_linerange(alpha = I(12/12))
p3 <- p2 + geom_point(aes(y = severe, x = YEAR))
p4 <- p3 + geom_hline(yintercept = (mean(natSevere$severe)),
   color = "grey", alpha = I(12/12)) + geom_hline(yintercept = c(mean(natSevere$severe) -
    (1.09 * sqrt(var(natSevere$severe))), mean(natSevere$severe) +
    (1.09 * sqrt(var(natSevere$severe)))), lty = 2, color = "grey",
    alpha = I(8/12))
severePlot1 <- p4 + theme_bw()
ggsave(file = "~/severePlot1.jpg", severePlot1)

xtable(natSevere)
```

```r
# stratify by region
regSevere <- svyby(~severe, ~region + YEAR, injsvy, svymean,
    na.rm = T, keep.var = TRUE, multicore = T)

regSevere

xtable(regSevere)

severePlot2

regSevere$lower <- regSevere$severe - (1.96 * regSevere$se)
regSevere$upper <- regSevere$severe + (1.96 * regSevere$se)


p1 <- ggplot(data = regSevere, aes(y = severe, ymin = lower,
    ymax = upper, x = YEAR)) + ylim(0, 0.4) + xlab("Year") +
    ylab("Proportion Admissions with Severe Injuries (95% CI)")
p2 <- p1 + geom_linerange(alpha = I(12/12))
p3 <- p2 + geom_point(aes(y = severe, x = YEAR))
p4 <- p3 + geom_hline(yintercept = (mean(regSevere$severe)),
   color = "grey", alpha = I(12/12)) + geom_hline(yintercept = c(mean(regSevere$severe) -
    (1.09 * sqrt(var(regSevere$severe))), mean(regSevere$severe) +
    (1.09 * sqrt(var(regSevere$severe)))), lty = 2, color = "grey",
    alpha = I(8/12)) + facet_wrap(~region)
severePlot2 <- p4 + theme_bw()
ggsave(file = "~/severePlot2.jpg", severePlot2)

regSevereReg <- lm(severe ~ YEAR + region + YEAR:region, data = regSevere)

summary(regSevereReg)

xtable(summary(regSevereReg))

# injury severity by income group

incSevere <- svyby(~severe, by = ~ZIPINC_QRTL, injsvy, svymean,
    na.rm = T, keep.var = TRUE, multicore = T)
round(incSevere, 3)

xtable(round(incSevere, 4))

incANOVAreg <- svyglm(severe ~ ZIPINC_QRTL, injsvy)

summary(incANOVAreg)

stargazer(incANOVAreg)
```

```r
# injury severity by age group

class(inj$ageGrp)

# svy not accepting character version of age group as a by=
# variable...
inj$ageGrp.num[inj$ageGrp == "1.LT18"] <- 1
inj$ageGrp.num[inj$ageGrp == "2.GT17.LT45"] <- 2
inj$ageGrp.num[inj$ageGrp == "3.GT44.LT65"] <- 3
inj$ageGrp.num[inj$ageGrp == "4.GT64.LT85"] <- 4
inj$ageGrp.num[inj$ageGrp == "5.GT84"] <- 5

ageSevere <- svyby(~severe, by = ~ageGrp.num, injsvy, svymean,
    na.rm = T, keep.var = TRUE)
round(ageSevere, 3)

xtable(ageSevere)

ageANOVAreg <- svyglm(severe ~ ageGrp.num, injsvy)

summary(ageANOVAreg)

stargazer(ageANOVAreg)

# injury severity by age group over time
ageSevere_yr <- svyby(~severe, by = ~ageGrp.num + YEAR, injsvy,
    svymean, na.rm = T, keep.var = TRUE, nulticore = T)

ageSevere_yr

ageSevere_yr$lower <- ageSevere_yr$severe - (1.96 * ageSevere_yr$se)
ageSevere_yr$upper <- ageSevere_yr$severe + (1.96 * ageSevere_yr$se)

mf_labeller <- function(var, value) {
    value <- as.character(value)
    if (var == "ageGrp.num") {
        value[value == 1] <- "0 to 18"
        value[value == 2] <- "18 to 44"
        value[value == 3] <- "45 to 64"
        value[value == 4] <- "65 to 84"
        value[value == 5] <- "Over 84"
    }
    return(value)
}

ageSeverePlot
```

```
p1 <- ggplot(data = ageSevere_yr, aes(y = severe, ymin = lower,
    ymax = upper, x = YEAR)) + ylim(0, 0.5) + xlab("Year") +
    ylab("Proportion Admissions with Severe Injuries (95% CI)")
p2 <- p1 + geom_linerange(alpha = I(12/12))
p3 <- p2 + geom_point(aes(y = severe, x = YEAR))
p4 <- p3 + facet_grid(. ~ ageGrp.num, labeller = mf_labeller) +
    theme_bw()
ageSeverePlot_yr <- p4
ggsave(file = "~/ageSeverePlot_yr.jpg", ageSeverePlot_yr)
```

1.3 hospital type

1.3.1 teaching hospitals

32.6% (95% CI 31.1, 34.0) trauma discharges from teaching hospitals severely injured, compared to 18.7% (95% CI 17.9, 19.5) non-teaching hospitals. Survey-adjusted logistic regression model, severely injured trauma patients more than twice as likely to be discharged from a teaching hospital than from a non-teaching hospital (OR =2.1, 95% CI 1.9, 2.3, Table 3.2) Evidence of a trend for the annual increases in the proportion of severe injuries admitted to teaching hospitals compared to non-teaching hospitals. (Figure **??**). Simple linear model for this trend indicates effect was small (β coefficient for effect of year = 0.004, 95% CI 0.001, 0.007). Teaching hospitals had a higher injury case fatality rate than non-teaching hospitals (2.84% (se .06%) vs 1.94% (se .03%))

```
injsvy <- svydesign(id = ~HOSPID, strata = ~NIS_STRATUM, weights = ~DISCWT,
    nest = TRUE, data = inj)

table(inj$HOSP_TEACH)  # yes or no

table(inj$HOSP_BEDSIZE)  # 1,2,3  sm med lrg

teachSevere1 <- svyby(~severe, ~HOSP_TEACH, injsvy, svymean,
    na.rm = T, keep.var = TRUE, multicore = T)

teachSevere1
teachSevere1$severe - (1.96 * teachSevere1$se)
teachSevere1$severe + (1.96 * teachSevere1$se)

teachSevereOR <- svyglm(severe ~ HOSP_TEACH, injsvy, family = binomial(logit))

xtable(summary(teachSevereOR))

exp(cbind(OR = coef(teachSevereOR), confint(teachSevereOR)))[2,
    ]
```

```
# excess proportion of severe injuries going to teaching
# hospitals
teachSevere2 <- svyby(~severe, ~HOSP_TEACH + YEAR, injsvy, svymean,
    na.rm = T, keep.var = TRUE, multicore = T)

teachSevere2

Diff <- (teachSevere2$severe[teachSevere2$HOSP_TEACH == 1] -
    teachSevere2$severe[teachSevere2$HOSP_TEACH == 0])
se.Diff <- sqrt((teachSevere2$se[teachSevere2$HOSP_TEACH == 1])^2 +
    teachSevere2$se[teachSevere2$HOSP_TEACH == 0]^2)
ci.Diff.low <- Diff - (1.96 * se.Diff)
ci.Diff.up <- Diff + (1.96 * se.Diff)
prop.Diff <- round(((teachSevere2$severe[teachSevere2$HOSP_TEACH ==
   1] - teachSevere2$severe[teachSevere2$HOSP_TEACH == 0])/teachSevere2$severe[teachSevere2$HOSP_TEA
    0]) * 100, 2)
Year <- 2000:2011

teachSevere2.dat <- data.frame(Year, Diff, se.Diff, ci.Diff.low,
    ci.Diff.up, prop.Diff)

teachSevere2.dat

xtable(teachSevere2.dat)

p1 <- ggplot(data = teachSevere2.dat, aes(y = Diff, ymin = ci.Diff.low,
    ymax = ci.Diff.up, x = Year)) + ylim(0, 0.2) + xlab("Year") +
    ylab("Difference in Proportion Admissions with Severe Injuries (95% CI)")
p2 <- p1 + geom_linerange(alpha = I(12/12))
p3 <- p2 + geom_point(aes(y = Diff, x = Year))
teachSeverePlot <- p3 + theme_bw()
ggsave(file = "~/teachSeverePlot.jpg", teachSeverePlot)

teachSevereReg <- lm(Diff ~ Year, data = teachSevere2.dat)
summary(teachSevereReg)

round(cbind(Coefficients = coef(teachSevereReg), confint(teachSevereReg)),
    3)

teachCFR <- svyby(~DIED, by = ~HOSP_TEACH, denominator = ~count,
    design = injsvy, svyratio, na.rm = T, keep.var = TRUE)

teachCFR

teachCFR.glm <- svyglm(DIED ~ HOSP_TEACH, injsvy, family = binomial(logit))

names(inj)
```

```r
summary(teachCFR.glm)

str(teachCFR.glm)

exp(teachCFR.glm$coefficients[2])  #   1.480272 (1.408333,1.555899)

exp(0.39223 + (1.96 * 0.02542))
exp(0.39223 - (1.96 * 0.02542))

teachCFR_yr <- svyby(~DIED, ~HOSP_TEACH + YEAR, injsvy, svymean,
    na.rm = T, keep.var = TRUE, multicore = T)

teachCFR_yr

Diff <- (teachCFR_yr2$DIED[teachCFR_yr$HOSP_TEACH == 1] - teachCFR_yr$DIED[teachCFR_yr$HOSP_TEACH ==
    0])
se.Diff <- sqrt((teachCFR_yr$se[teachCFR_yr$HOSP_TEACH == 1])^2 +
    teachCFR_yr$se[teachCFR_yr$HOSP_TEACH == 0]^2)
ci.Diff.low <- Diff - (1.96 * se.Diff)
ci.Diff.up <- Diff + (1.96 * se.Diff)
prop.Diff <- round(((teachCFR_yr$DIED[teachCFR_yr$HOSP_TEACH ==
   1] - teachCFR_yr$DIED[teachCFR_yr$HOSP_TEACH == 0])/teachCFR_yr$DIED[teachCFR_yr$HOSP_TEACH ==
    0]) * 100, 2)
Year <- 2000:2011

teachCFR_yr.dat <- data.frame(Year, Diff, se.Diff, ci.Diff.low,
    ci.Diff.up, prop.Diff)

teachCFR_yr.dat

p1 <- ggplot(data = teachCFR_yr.dat, aes(y = Diff, ymin = ci.Diff.low,
    ymax = ci.Diff.up, x = Year)) + ylim(0, 0.2) + xlab("Year") +
    ylab("Difference in Proportion Admissions with Severe Injuries (95% CI)")
p2 <- p1 + geom_linerange(alpha = I(12/12))
p3 <- p2 + geom_point(aes(y = Diff, x = Year))
teachDIEDPlot <- p3 + theme_bw()
teachDIEDPlot
ggsave(file = "~/teachDIEDPlot.jpg", teachDIEDPlot)

teachDIEDReg <- lm(Diff ~ Year, data = teachCFR_yr.dat)

summary(teachDIEDReg)
```

1.3.2 trauma centers

73 of the 4,345 hospitals (1.7%) included in the sample were level 1 trauma centers. 133 (3.1%) were level 2 trauma centers. Total of 2,399,216 (95% CI 2337204, 2461228) injured patients discharged from level 1 trauma centers during the study period. Represents 11.6% (95% CI 8.0, 15.2) all injury and trauma discharges. Pproportion of severely injured trauma patients at level-one trauma centers 39.4% (95% CI 36.8, 42.1) compared to 24.1% (95% CI 23.2, 25.1) patients at non-trauma centers. Difference in the proportions severely injured patients treated at level-one trauma centers vs. non-level-one trauma centers stable. (Figure 14) Linear regression term for yearly trend in the proportion difference of severely injured patients in level-1 trauma vs non-level-1 trauma centers not statistically significant (β coefficient for effect of year = -0.003, 95% CI -0.007, 0.001). Unadjusted case fatality ratio in level-one trauma centers 3.4% (95% CI 3.2, 3.7) compared to 2.3% (95% CI 2.2, 2.3) non-level one trauma centers. Survey logistic regression model, unadjusted association of level one trauma status with inpatient mortality 1.53 (95% CI 1.4, 1.7).

```
injsvy <- svydesign(id = ~HOSPID, strata = ~NIS_STRATUM, weights = ~DISCWT,
    nest = TRUE, data = inj)

table(inj$Trauma.Status)

tab1 <- table(inj$HOSPID, inj$Trauma.Status)

tab1 <- as.data.frame.matrix(tab1)

names(tab1) <- c("zero", "one", "two", "three", "four", "five",
    "not")

nrow(tab1[tab1$one != 0, ])  #73
length(unique(inj$HOSPID))  # 4345
round(nrow(tab1[tab1$one != 0, ])/length(unique(inj$HOSPID)) *
    100, 2)  # 1.68

nrow(tab1[tab1$two != 0, ])  #133
round(nrow(tab1[tab1$two != 0, ])/length(unique(inj$HOSPID)) *
    100, 2)  # 3.06

tab1

round(table(inj$Trauma.Status)/nrow(inj) * 100, 2)

tot.center <- svytotal(~Trauma.Status, injsvy, na.rm = T, keep.var = TRUE,
    multicore = T)

tot.center

2399216 - (1.96 * 31639)  # 2337204
```

```r
2399216 + (1.96 * 31639)  # 2461228


# create numeric version of level 1 trauma status for use
# with svyratio
inj$level.one <- 0
inj$level.one[inj$Trauma.Status == 1] <- 1

table(inj$level.one)  # 479,559

center.mean <- svymean(~level.one, injsvy, na.rm = T, keep.var = TRUE,
    multicore = T)
center.mean
# level.one 0.11613 0.0184

0.11613 - (1.96 * 0.0184)  # 0.080066
0.11613 + (1.96 * 0.0184)  # 0.152194

centerSevere1 <- svyby(~severe, ~level.one, injsvy, svymean,
    na.rm = T, keep.var = TRUE, multicore = T)
centerSevere1

centerSevere1$severe - (1.96 * centerSevere1$se)

centerSevere1$severe + (1.96 * centerSevere1$se)

centerSevere2 <- svyby(~severe, ~level.one + YEAR, injsvy, svymean,
    na.rm = T, keep.var = TRUE, multicore = T)
centerSevere2

Diff <- (centerSevere2$severe[centerSevere2$level.one == 1] -
    centerSevere2$severe[centerSevere2$level.one == 0])
se.Diff <- sqrt((centerSevere2$se[centerSevere2$level.one ==
    1])^2 + centerSevere2$se[centerSevere2$level.one == 0]^2)
ci.Diff.low <- Diff - (1.96 * se.Diff)
ci.Diff.up <- Diff + (1.96 * se.Diff)
prop.Diff <- round(((centerSevere2$severe[centerSevere2$level.one ==
   1] - centerSevere2$severe[centerSevere2$level.one == 0])/centerSevere2$severe[centerSevere2$level
    0]) * 100, 2)
Year <- 2000:2011

centerSevere2.dat <- data.frame(Year, Diff, se.Diff, ci.Diff.low,
    ci.Diff.up, prop.Diff)

centerSevere2.dat

xtable(centerSevere2.dat)
```

```
p1 <- ggplot(data = centerSevere2.dat, aes(y = Diff, ymin = ci.Diff.low,
    ymax = ci.Diff.up, x = Year)) + ylim(0, 0.3) + xlab("Year") +
    ylab("Difference in Proportion Admissions with Severe Injuries (95% CI)")
p2 <- p1 + geom_linerange(alpha = I(12/12))
p3 <- p2 + geom_point(aes(y = Diff, x = Year))
p4 <- p3 + theme_bw()
centerSeverePlot <- p4
ggsave(file = "~/centerSeverePlot.jpg", centerSeverePlot)

centerSevereReg <- lm(Diff ~ Year, data = centerSevere2.dat)
summary(centerSevereReg)

round(cbind(Coefficients = coef(centerSevereReg), confint(centerSevereReg)),
    3)

centerCFR <- svyby(~DIED, by = ~level.one, denominator = ~count,
    design = injsvy, svyratio, na.rm = T, keep.var = TRUE, multicore = T)

centerCFR

0.02269223 - (1.96 * 0.000344079)

centerCFR.glm <- svyglm(DIED ~ level.one, injsvy, family = binomial(logit))

summary(centerCFR.glm)

names(inj)

summary(centerCFR.glm)

str(teachCFR.glm)

exp(centerCFR.glm$coefficients[2])  #   1.536413 (1.421143, 1.661031)

exp(0.42945 + (1.96 * 0.03979))
exp(0.42945 - (1.96 * 0.03979))
```

4,345 non-survey adjusted hospitals in the trauma data set, 3,643 neither teaching hospitals or level-one trauma centers at any point during the 11-year period. 860 teaching hospitals at some point ; 73 hospitals level-one trauma centers at some point during the study period. 65 hospitals both teaching hospitals and trauma centers. Teaching hospitals that are also trauma centers discharged same proportion of severely injured patients (39.9%, 95% CI 25.1, 46.6) as full set of level-one trauma centers.

```
length(unique(inj$HOSPID))  # 4345
length(unique(inj$HOSPID[inj$level.one == 1]))  # 73
length(unique(inj$HOSPID[inj$HOSP_TEACH == 1]))  # 860
```

```
length(unique(inj$HOSPID[inj$level.one == 1 & inj$HOSP_TEACH ==
    1]))  # 65
length(unique(inj$HOSPID[inj$level.one == 0 & inj$HOSP_TEACH ==
    1]))  # 797
length(unique(inj$HOSPID[inj$level.one == 1 & inj$HOSP_TEACH ==
    0]))  # 12
length(unique(inj$HOSPID[inj$level.one == 0 & inj$HOSP_TEACH ==
    0]))  # 3643

inj$teachCenter <- 0
inj$teachCenter[inj$HOSP_TEACH == 1 & inj$level.one == 1] <- 1

injsvy <- svydesign(id = ~HOSPID, strata = ~NIS_STRATUM, weights = ~DISCWT,
    nest = TRUE, data = inj)


teachCenterSevere1 <- svyby(~severe, ~teachCenter, injsvy, svymean,
    na.rm = T, keep.var = TRUE, multicore = T)
teachCenterSevere1

teachCenterSevere1$severe - (1.96 * teachCenterSevere1$se)

teachCenterSevere1$severe + (1.96 * teachCenterSevere1$se)
```

Teaching hospitals that were not level-one trauma centers discharged a smaller proportion of severely injured patients (30.6%, 95% CI 24.8, 32.1).

```
inj$nonCenterTeach <- 0
inj$nonCenterTeach[inj$HOSP_TEACH == 1 & inj$level.one == 0] <- 1

injsvy <- svydesign(id = ~HOSPID, strata = ~NIS_STRATUM, weights = ~DISCWT,
    nest = TRUE, data = inj)

nonCenterTeachSevere1 <- svyby(~severe, ~nonCenterTeach, injsvy,
    svymean, na.rm = T, keep.var = TRUE, multicore = T)
nonCenterTeachSevere1

nonCenterTeachSevere1$severe - (1.96 * nonCenterTeachSevere1$se)

nonCenterTeachSevere1$severe + (1.96 * nonCenterTeachSevere1$se)
```

Looking at the overall proportion of severely injured trauma patients, while representing only 10.9% of all hospitals, the largest proportion (39%) go to teaching hospitals that are trauma centers, the next highest proportion (30.6%) go to non-level-one trauma teaching hospitals which represent about 39.9% of all hospitals; non-teaching, non-level-one trauma centers represent 49.1% of hospitals and see about 18% of the severely injured patients in the US.

```r
inj$hospType <- 0
inj$hospType[inj$teachCenter == 1] <- 1
inj$hospType[inj$nonCenterTeach == 1] <- 2

injsvy <- svydesign(id = ~HOSPID, strata = ~NIS_STRATUM, weights = ~DISCWT,
    nest = TRUE, data = inj)

hospTab <- svytable(~hospType + severe, injsvy)
hospTab

hospTab2 <- svyby(~severe, ~hospType, design = injsvy, svyciprop,
    vartype = "ci", method = "beta", multicore = T)

hospTab2

hospTab3 <- svyciprop(~hospType, injsvy, vartype = "ci", method = "beta",
    multicore = T)
hospTab3

hospTab3 <- svyby(~TBI, by = ~YEAR, denominator = ~count, design = injsvy,
    FUN = svyratio, na.rm = T, multicore = TRUE)

svymean(~nonCenterTeach, injsvy, multicore = T)

svymean(~teachCenter, injsvy, multicore = T)

1 - (0.39909 + 0.10913)  # [1] 0.49178
```

1.4 injury categories

Table 14 frequencies and proportions of injury types by Barrel Matrix categories. Table 15 presents least detailed Barrel Matrix cross classification of injury type by location. Same information presented as a heat map of proportions in figure 15. Figures 16, 17 and 18 present head maps on the proportions of *severe* injuries by increasing detail of Barrel Matrix classification. Table 3.2 lists overall frequency and proportion of the anatomic location of injuries in the US during the study period. Table 3.2 presents anatomical location of trauma discharges cross-referenced by type of injury.

```r
injsvy <- svydesign(
                id = ~HOSPID ,
                strata = ~NIS_STRATUM ,
                weights = ~DISCWT ,
                nest = TRUE,
                data = inj,
                multicore=T
        )
```

```
        # counts of single barrel matrix categories

names(inj)
system.time(ISRCODE.descr<-svytotal(~ISRCODE.descr, injsvy))
# system.time(ISRSITE.descr<-svytotal(~ISRSITE.descr, injsvy, multicore=T)) # 28 seconds, seems to be
ISRSITE.descr<-svytotal(~ISRSITE.descr, injsvy, na.rm=T)
system.time(ISRSITE2.descr<-svytotal(~ISRSITE2.descr, injsvy, na.rm=T))
ISRSITE3.descr<-svytotal(~ISRSITE3.descr, injsvy, na.rm=T)

ISRCODE.descr.dat<-as.data.frame(ISRCODE.descr)
ISRCODE.descr.dat$proportion<-round(ISRCODE.descr.dat$total/sum(ISRCODE.descr.dat$total)*100,2)
ISRCODE.descr.dat$lower<-round((ISRCODE.descr.dat$total-(1.96*ISRCODE.descr.dat$SE))/sum(ISRCODE.de
ISRCODE.descr.dat$upper<-round((ISRCODE.descr.dat$total+(1.96*ISRCODE.descr.dat$SE))/sum(ISRCODE.de
ISRCODE.descr.dat

xtable(ISRCODE.descr.dat)

ISRSITE.descr.dat<-as.data.frame(ISRSITE.descr)
ISRSITE.descr.dat$proportion<-round(ISRSITE.descr.dat$total/sum(ISRSITE.descr.dat$total)*100,2)
ISRSITE.descr.dat$lower<-round((ISRSITE.descr.dat$total-(1.96*ISRSITE.descr.dat$SE))/sum(ISRSITE.de
ISRSITE.descr.dat$upper<-round((ISRSITE.descr.dat$total+(1.96*ISRSITE.descr.dat$SE))/sum(ISRSITE.de
ISRSITE.descr.dat

ISRSITE2.descr.dat<-as.data.frame(ISRSITE2.descr)
ISRSITE2.descr.dat$proportion<-round(ISRSITE2.descr.dat$total/sum(ISRSITE2.descr.dat$total)*100,2)
ISRSITE2.descr.dat$lower<-round((ISRSITE2.descr.dat$total-(1.96*ISRSITE2.descr.dat$SE))/sum(ISRSITE
ISRSITE2.descr.dat$upper<-round((ISRSITE2.descr.dat$total+(1.96*ISRSITE2.descr.dat$SE))/sum(ISRSITE
ISRSITE2.descr.dat

xtable(ISRSITE2.descr.dat)

ISRSITE3.descr.dat<-as.data.frame(ISRSITE3.descr)
ISRSITE3.descr.dat$proportion<-round(ISRSITE3.descr.dat$total/sum(ISRSITE3.descr.dat$total)*100,2)
ISRSITE3.descr.dat$lower<-round((ISRSITE3.descr.dat$total-(1.96*ISRSITE3.descr.dat$SE))/sum(ISRSITE
ISRSITE3.descr.dat$upper<-round((ISRSITE3.descr.dat$total+(1.96*ISRSITE3.descr.dat$SE))/sum(ISRSITE
ISRSITE3.descr.dat

xtable(ISRSITE3.descr.dat)

# frequency and proportion matrices and heatmaps

# cross tab counts site by category 3

codeXsite3<-svytable(~ISRCODE.descr+ISRSITE3.descr, injsvy)
```

```r
codeXsite3<-addmargins(codeXsite3)
round(codeXsite3)

xtable(round(codeXsite3))

# cross tab proportions site by category 3

codeXsite3.prop<-(round(codeXsite3.prop,4)*100)*4

codeXsite3.prop

xtable(codeXsite3.prop)

str(codeXsite3.prop)

# heat map cross tab proportions site by category 3
library(gplots)
library( RColorBrewer)
my_palette <- colorRampPalette(c("yellow", "green", "red"))(n = 299)

col_breaks = c(seq(0,1,length=100),  # for yellow
  seq(1,50,length=100),              # for green
  seq(50,100,length=100))              # for red


  jpeg("~/heat1.jpg",
    width = 5*400,        # 5 x 300 pixels
    height = 5*300,
    res = 300,            # 300 pixels per inch
    pointsize = 8)

heatmap.2(codeXsite3.prop[1:13, 1:5], # removing marginal totals
  cellnote = codeXsite3.prop,
  main = "Proportion",
  notecol="black",
  density.info="none",
  trace="none",
  margins =c(11,12),
  col=my_palette,
  breaks=col_breaks,
  dendrogram="none",
  Colv="NA", cexRow = 1, ,cexCol = .9)

dev.off()

# isrsite2 matrix
system.time(codeXsite2<-svytable(~ISRCODE.descr+ISRSITE2.descr, injsvy))
```

```
codeXsite2<-round(codeXsite2)

codeXsite2<-addmargins(codeXsite2)

codeXsite2


# isrsite matrix
codeXsite<-svytable(~ISRCODE.descr+ISRSITE.descr, injsvy)

addmargins(round(t(codeXsite)))

# proportion severe tables and heat maps
system.time(barrel3Severe<-svyby(~severe, ~ISRCODE.descr+ISRSITE3.descr, injsvy, svymean,na.rm=T, ke

barrel3Severe

library(reshape2)
barrel3Severe.mat<-acast(barrel3Severe, ISRCODE.descr~ISRSITE3.descr, value.var="severe")

barrel3Severe.mat[is.na(barrel3Severe.mat)]<-0

colnames(barrel3Severe.mat)[5]<-"UNCLASSIFIABLE"

barrel3Severe.mat

xtable(barrel3Severe.mat)

# normalize to compare with heatmap
addmargins(barrel3Severe.mat/sum(barrel3Severe.mat)*100)

barrel3Severe.mat.map<-barrel3Severe.mat/sum(barrel3Severe.mat)*100

library(gplots)
library( RColorBrewer)
my_palette <- colorRampPalette(c("yellow", "green", "red"))(n = 299)

col_breaks = c(seq(0,1,length=100),  # for yellow
  seq(1,50,length=100),              # for green
  seq(50,100,length=100))              # for red


  jpeg("~/heat2.jpg",
    width = 5*400,        # 5 x 300 pixels
    height = 5*300,
    res = 300,            # 300 pixels per inch
```

```
    pointsize = 8)

heatmap.2(barrel3Severe.mat.map, # removing marginal totals
  cellnote = round(barrel3Severe.mat.map,3),
  main = "Percentage of All Severe Injuries",
  notecol="black",
  density.info="none",
  trace="none",
  margins =c(11,12),
  col=my_palette,
  breaks=col_breaks,
  dendrogram="none",
  Colv="NA", ,cexRow = 1, ,cexCol = .9)

dev.off()

# see what a heat map of more detailed descriptive categories looks like

system.time(barrel2Severe<-svyby(~severe, ~ISRCODE.descr+ISRSITE2.descr, injsvy, svymean,na.rm=T, ke

barrel2Severe

barrel2Severe.mat<-acast(barrel2Severe, ISRCODE.descr~ISRSITE2.descr, value.var="severe")

barrel2Severe.mat[is.na(barrel2Severe.mat)]<-0

barrel2Severe.mat

# colnames(barrel2Severe.mat)[5]<-"UNCLASSIFIABLE"

barrel2Severe.mat

# normalize to compare with heatmap

round(addmargins(barrel2Severe.mat/sum(barrel2Severe.mat)*100),2)

barrel2Severe.mat.map<-barrel2Severe.mat/sum(barrel2Severe.mat)*100

oldpar<-par()

par(oldpar)

# library(gplots)
# library( RColorBrewer)
my_palette <- colorRampPalette(c("yellow", "green", "red"))(n = 299)

# par(mar=c(2,2,2,2))
```

```
col_breaks = c(seq(0,1,length=100),  # for yellow
  seq(1,50,length=100),              # for green
  seq(50,100,length=100))              # for red


  jpeg("~/heat3.jpg",
    width = 5*400,        # 5 x 300 pixels
    height = 5*300,
    res = 300,            # 300 pixels per inch
    pointsize = 5)

heatmap.2(barrel2Severe.mat.map, # removing marginal totals
  cellnote = round(barrel2Severe.mat.map,2),
  main = "Percentage of All Severe Injuries",
  notecol="black",
  density.info="none",
  trace="none",
  margins =c(8,12),
  col=my_palette,
  breaks=col_breaks,
  dendrogram="none",
  Colv="NA", ,cexRow = 1, ,cexCol = .9,)

dev.off()

system.time(barrel1Severe<-svyby(~severe, ~ISRCODE.descr+ISRSITE.descr, injsvy, svymean,na.rm=T, kee



round_df <- function(x, digits) {
    # round all numeric variables
    # x: data frame
    # digits: number of digits to round
    numeric_columns <- sapply(x, class) == 'numeric'
    x[numeric_columns] <-  round(x[numeric_columns], digits)
    x
}

round_df(barrel1Severe, 3)

barrel1Severe.mat<-acast(barrel1Severe, ISRCODE.descr~ISRSITE.descr, value.var="severe")

barrel1Severe.mat[is.na(barrel1Severe.mat)]<-0

# colnames(barrel2Severe.mat)[5]<-"UNCLASSIFIABLE"

barrel2Severe.mat
```

```
round(addmargins(barrel2Severe.mat/sum(barrel2Severe.mat)*100),2)

barrel1Severe.mat.map<-barrel1Severe.mat/sum(barrel1Severe.mat)*100

# library(gplots)
# library( RColorBrewer)
my_palette <- colorRampPalette(c("yellow", "green", "red"))(n = 299)


col_breaks = c(seq(0,1,length=100),  # for yellow
  seq(1,50,length=100),              # for green
  seq(50,100,length=100))              # for red


  jpeg("~/heat4.jpg",
    width = 5*600,        # 5 x 300 pixels
    height = 5*400,
    res = 300,            # 300 pixels per inch
    pointsize = 8)

heatmap.2(barrel1Severe.mat.map, # removing marginal totals
  cellnote = round(barrel1Severe.mat.map,2),
  main = "Proportion of Total Severe",
  notecol="black",
  density.info="none",
  trace="none",
  margins =c(11,14),
  col=my_palette,
  breaks=col_breaks,
  dendrogram="none",
  Colv="NA", ,cexRow = 1, ,cexCol = .75, key=F)

dev.off()
```

1.4.1 Barrel matrix over time

Decline in the proportion of annual admissions of extremity injuries, increase in the proportion of TBI injuries. Torso injuries stable. (Figure 19) Oldest patients accounted for the increase in TBI admissions over time. Percentage TBI of Annual Admissions by Age Group. (Figure 20) US Hospitals 2000-2011

```
# need to create indicator variables for the outcomes you
# want to count up over time (svyratio will not tabulate
# non-numerics)
inj$TBI <- 0
inj$TBI[inj$ISRSITE2.descr == "TBI"] <- 1
```

```r
table(inj$TBI)

inj$Extremity <- 0
inj$Extremity[inj$ISRSITE2.descr == "UPPER EXTREMITY" | inj$ISRSITE2.descr ==
    "LOWER EXTREMITY"] <- 1

inj$Torso <- 0
inj$Torso[inj$ISRSITE2.descr == "TORSO"] <- 1

inj$Spine <- 0
inj$Spine[inj$ISRSITE2.descr == "SCI" | inj$ISRSITE2.descr ==
    "VCI"] <- 1

injsvy <- svydesign(id = ~HOSPID, strata = ~NIS_STRATUM, weights = ~DISCWT,
    nest = TRUE, data = inj, multicore = T)

system.time(TBI <- svyby(~TBI, by = ~YEAR, denominator = ~count,
    design = injsvy, FUN = svyratio, na.rm = T, multicore = TRUE))
system.time(Extremity <- svyby(~Extremity, by = ~YEAR, denominator = ~count,
    design = injsvy, FUN = svyratio, na.rm = T, multicore = TRUE))
system.time(Torso <- svyby(~Torso, by = ~YEAR, denominator = ~count,
    design = injsvy, FUN = svyratio, na.rm = T, multicore = TRUE))
system.time(Spine <- svyby(~Spine, by = ~YEAR, denominator = ~count,
    design = injsvy, FUN = svyratio, na.rm = T, multicore = TRUE))

TBI
Extremity
Torso
Spine

names(TBI) <- c("Year", "Proportion", "se")
names(Extremity) <- c("Year", "Proportion", "se")
names(Torso) <- c("Year", "Proportion", "se")
names(Spine) <- c("Year", "Proportion", "se")


TBI$Injury <- "TBI"
Extremity$Injury <- "Extremity"
Torso$Injury <- "Torso"
Spine$Injury <- "Spine"

injXtime <- rbind(TBI, Extremity, Torso, Spine)

injXtime$Percent <- injXtime$Proportion * 100

injXtime$Percent
```

```
p1 <- ggplot(data = injXtime[!injXtime$Injury == "Spine", ],
    aes(x = Year, y = Percent))
p2 <- p1 + geom_line(aes(group = 1)) + ylim(0, 60) + xlim(2000,
    2011) + geom_smooth(aes(group = 1), size = 1.5) + facet_wrap(~Injury)
p3
p3 <- p2 + ylab("Injury Type as a Percentage of Total Admissionsw") +
    theme_bw() + scale_x_continuous(breaks = seq(2000, 2011,
    2))
barrelTimePlot1 <- p3
ggsave(file = "~/barrelTimePlot1.jpg", barrelTimePlot1)

system.time(TBI_time_age <- svyby(~TBI, by = ~YEAR + ageGrp.num,
    denominator = ~count, design = injsvy, FUN = svyratio, na.rm = T,
    multicore = TRUE))

names(TBI_time_age) <- c("Year", "Age", "Proportion", "se")
TBI_time_age$Percent <- TBI_time_age$Proportion * 100

# need to futz around a bit to get the facet labels
# correct...
mf_labeller <- function(var, value) {
    value <- as.character(value)
    if (var == "Age") {
        value[value == 1] <- "0 to 18"
        value[value == 2] <- "18 to 44"
        value[value == 3] <- "45 to 64"
        value[value == 4] <- "65 to 84"
        value[value == 5] <- "Over 84"
    }
    return(value)
}

p1 <- ggplot(data = TBI_time_age, aes(x = Year, y = Percent))
p2 <- p1 + geom_line(aes(group = 1)) + ylim(0, 20) + xlim(2000,
    2011) + geom_smooth(aes(group = 1), size = 1.5) + facet_grid(. ~
    Age, labeller = mf_labeller)
p3 <- p2 + ylab("TBI as Percentage of Total Admissions") + theme_bw() +
    scale_x_continuous(breaks = seq(2000, 2011, 2))
TBIyearAgePlot <- p3
ggsave(file = "~/TBIyearAgePlot.jpg", TBIyearAgePlot)


TBI_time_age
```

1.5 charges and costs

Weight for charges different in 2000 than for rest of study period; charges calculated for the 10-year period 2001-2011. Total US inpatient injury-related hospital charges $677.09 Billion (95% CI 619.62, 734.56). Annual total US inpatient injury-related hospital charges increased each year between 2001 and 2011. (Figure 21) Nearly double from $32.52 Billion (95% CI 27.28, 37.76) in 2001 to %84.62 (95% CI 69.25, 99.99) in 2011. [2]

```
inj2 <- inj[inj$YEAR != 2000, ]

injsvy2 <- svydesign(id = ~HOSPID, strata = ~NIS_STRATUM, weights = ~DISCWT,
    nest = TRUE, data = inj2)

tot.charges <- svytotal(~TOTCHG, injsvy2, na.rm = T, keep.var = TRUE,
    multicore = T)

tot.charges

# total SE

tot.charges/1e+09

# total SE TOTCHG 677.09 2.9323e+10

(6.7709e+11 - (1.96 * 2.9323e+10))/1e+09
(6.7709e+11 + (1.96 * 2.9323e+10))/1e+09

yrly.charges <- svyby(~TOTCHG, ~YEAR, injsvy2, na.rm = T, svytotal,
    keep.var = TRUE, multicore = T)

names(yrly.charges)

yrly.charges$billions <- yrly.charges$TOTCHG/1e+09
yrly.charges$billions.se <- yrly.charges$se/1e+09
yrly.charges$upper <- yrly.charges$billions + (1.96 * yrly.charges$billions.se)
yrly.charges$lower <- yrly.charges$billions - (1.96 * yrly.charges$billions.se)

yrly.charges

(84.62018 - 32.52214)/32.52214 * 100

p1 <- ggplot(data = yrly.charges, aes(y = billions, ymin = lower,
    ymax = upper, x = YEAR)) + ylim(0, 120) + xlab("Year") +
    ylab("Total Charges in $Billions (95% CI)")
p2 <- p1 + geom_linerange(alpha = I(12/12))
p3 <- p2 + geom_point(aes(y = billions, x = YEAR))
```

[2] For costs, need to use the HCUP NIS Cost to Charge Ratio file specific to that year.

```
p4 <- p3 + geom_smooth() + theme_bw() + scale_x_continuous(breaks = seq(2001,
    2011, 2))
chargePlot1 <- p4
ggsave(file = "~/chargePlot1.jpg", chargePlot1)

# regression for the effect of year on cost
charge.mod <- lm(billions ~ YEAR, data = yrly.charges)

summary(charge.mod)

stargazer(charge.mod)

# READING IN AND CREATING COST TO CHARGE RATIO FILES
# 2001-2005
cc2001 <- read.csv("~/HCUP CCR/cc2001NIS.csv", header = T, stringsAsFactors = F)
str(cc2001)

cc2002 <- read.csv("~/HCUP CCR/cc2002NIS.csv", header = T, stringsAsFactors = F)
str(cc2002)

cc2003 <- read.csv("~/HCUP CCR/cc2003NIS.csv", header = T, stringsAsFactors = F)
str(cc2003)

cc2004 <- read.csv("~/HCUP CCR/cc2004NIS.csv", header = T, stringsAsFactors = F)
str(cc2004)
cc2004 <- cc2004[, -c(7, 8)]


cc2005 <- read.csv("~/HCUP CCR/cc2005NIS.csv", header = T, stringsAsFactors = F)
str(cc2005)
cc2005 <- cc2005[, -c(7, 8)]

names(cc2001) <- c("HOSPID", "YEAR", "Z013", "GAPICC", "APICC",
    "WI_X")
names(cc2002) <- c("HOSPID", "YEAR", "Z013", "GAPICC", "APICC",
    "WI_X")
names(cc2003) <- c("HOSPID", "YEAR", "Z013", "GAPICC", "APICC",
    "WI_X")
names(cc2004) <- c("HOSPID", "YEAR", "Z013", "GAPICC", "APICC",
    "WI_X")
names(cc2005) <- c("HOSPID", "YEAR", "Z013", "GAPICC", "APICC",
    "WI_X")

ccr2001_2005 <- rbind(cc2001, cc2002, cc2003, cc2004, cc2005)

str(ccr2001_2005)
```

```
saveRDS(ccr2001_2005, "~/ccr2001_2005.rds")
```

1.6 Injury Mechanisms by Ecodes

Primary injury Ecode information available for 14,074,803 trauma discharges 2003 to 2011. Top ten injury mechanisms (Table 3.2). 3,811,988 (27.08%) of the entire set of Ecodes were associated with severe injuries (Table 3.2). Injury mechanisms by age group. Falls important in older age groups. Younger persons more likely admitted due to a violent assault. (Table 3.2 and Figure 22)

```
# ALL ECODES
ecodes <- read.csv("~/nis.00_11.ecode1InjCounts.csv", header = T,
    stringsAsFactors = F)

ecodes$colTotal <- rowSums(ecodes[, 2:10])

ecodes$totProp <- round((ecodes$colTotal/sum(ecodes$colTotal)) *
    100, 2)

ecodes <- arrange(ecodes, -totProp)

ecodes[1:11, 11:14]

# falls
sum(2646933, 2288542, 542571, 392894, 329418, 234318, 219240)  # 6,653,916
sum(18.81, 16.26, 3.85, 2.79, 2.34, 1.66, 1.56)  # 47.27%

# mvc's
sum(503106, 283703, 235812)  # 1,022,621
sum(3.57, 2.02, 1.68)  # 7.27%


# SEVERE ECODES

ecodes <- read.csv("~/nis.00_11.ecodeCountsSevere.csv", header = T,
    stringsAsFactors = F)

ecodes$colTotal <- rowSums(ecodes[, 2:10])

ecodes$totProp <- round((ecodes$colTotal/sum(ecodes$colTotal)) *
    100, 2)

ecodes <- arrange(ecodes, -totProp)

ecodes[1:11, 11:14]
```

```r
sum(ecodes$colTotal)  # 3811988
round(sum(ecodes$colTotal)/14074803 * 100, 2)  # 27.08%

# falls
sum(397067, 323493, 137559, 85514, 67061)
sum(10.42, 8.49, 3.61, 2.24, 1.76)


# mvc
sum(278624, 174610, 136054, 106253, 72230)
sum(7.31, 4.58, 3.57, 2.79, 1.89)

# ECODES BY AGEGROUP
ecodes <- read.csv("~/nis.00_11.ecodeCountsAgeGrp.csv", header = T,
    stringsAsFactors = F)

head(ecodes)

# younger than 18
ecodes <- arrange(ecodes, -X1.LT18)
LT18 <- as.data.frame.matrix(ecodes[1:5, c(2, 7, 8)])

LT18$AgeGroup <- "Younger than 18"
LT18$Percent <- round(LT18$X1.LT18/sum(ecodes$X1.LT18) * 100,
    2)
names(LT18) <- c("Total Count", "Ecode", "Description", "AgeGroup",
    "Percent of Total")
LT18 <- LT18[, c(4, 2, 3, 1, 5)]
LT18

names(ecodes)

# 17 to 45
ecodes <- arrange(ecodes, -X2.GT17.LT45)
(GT17.LT45 <- as.data.frame.matrix(ecodes[1:5, c(3, 7, 8)]))
GT17.LT45$AgeGroup <- "18 to 44"
GT17.LT45$Percent <- round(GT17.LT45$X2.GT17.LT45/sum(ecodes$X2.GT17.LT45) *
    100, 2)
names(GT17.LT45) <- c("Total Count", "Ecode", "Description",
    "AgeGroup", "Percent of Total")
GT17.LT45 <- GT17.LT45[, c(4, 2, 3, 1, 5)]
GT17.LT45


# 45 to 65
ecodes <- arrange(ecodes, -X3.GT44.LT65)
(GT44.LT65 <- as.data.frame.matrix(ecodes[1:5, c(4, 7, 8)]))
```

```
GT44.LT65$AgeGroup <- "45 to 64"
GT44.LT65$Percent <- round(GT44.LT65$X3.GT44.LT65/sum(ecodes$X3.GT44.LT65) *
    100, 2)
names(GT44.LT65) <- c("Total Count", "Ecode", "Description",
    "AgeGroup", "Percent of Total")
GT44.LT65 <- GT44.LT65[, c(4, 2, 3, 1, 5)]
GT44.LT65

# 65 to 85
ecodes <- arrange(ecodes, -X4.GT64.LT85)
(GT64.LT85 <- as.data.frame.matrix(ecodes[1:5, c(5, 7, 8)]))
GT64.LT85$AgeGroup <- "65 to 84"
GT64.LT85$Percent <- round(GT64.LT85$X4.GT64.LT85/sum(ecodes$X4.GT64.LT85) *
    100, 2)
names(GT64.LT85) <- c("Total Count", "Ecode", "Description",
    "AgeGroup", "Percent of Total")
GT64.LT85 <- GT64.LT85[, c(4, 2, 3, 1, 5)]
GT64.LT85

# older than 85
ecodes <- arrange(ecodes, -X5.GT84)
(GT84 <- as.data.frame.matrix(ecodes[1:5, c(6, 7, 8)]))
GT84$AgeGroup <- "85 and Older"
GT84$Percent <- round(GT84$X5.GT84/sum(ecodes$X5.GT84) * 100,
    2)
names(GT84) <- c("Total Count", "Ecode", "Description", "AgeGroup",
    "Percent of Total")
GT84 <- GT84[, c(4, 2, 3, 1, 5)]
GT84

ageGrpEcodes <- rbind(LT18, GT17.LT45, GT44.LT65, GT64.LT85,
    GT84)

ageGrpEcodes$Description[is.na(ageGrpEcodes$Description)] <- "Assault Cutting Piercing"


ageGrpEcodes

names(ageGrpEcodes)
p1 <- ggplot(transform(ageGrpEcodes, AgeGroup = factor(AgeGroup,
    levels = c("Younger than 18", "18 to 44", "45 to 64", "65 to 84",
      "85 and Older")), Description = factor(Description, level = c("Fall from playgrnd equip",
    "Fall-1 level to oth NEC", "Fall from slipping NEC", "Fall on stair/step NEC",
    "Fall from ladder", "Fall NEC", "Fall NOS", "Fall from bed",
    "Mv collision NOS-pasngr", "Ped cycl acc-ped cyclist", "Mv collision NOS-driver",
   "Loss control mv acc-driv", "Assault Cutting Piercing", "Unarmed fight or brawl"))),
   aes(x = Description, y = Percent.of.Total))  # transforming on the fly to rearrange order of age gr
```

```
p2 <- p1 + geom_bar(stat = "identity") + coord_flip()
p3 <- p2 + facet_grid(. ~ AgeGroup) + theme_bw()
ageGrpEcodePlot <- p3 + ylab("Percent of Total Ecodes") + xlab("Ecode Description")
ggsave(file = "~/ageGrpEcodePlot.jpg", ageGrpEcodePlot)
```

1.7 Procedures

14,219,737 procedures listed for discharged trauma patients during study period. (Table 21) Table for *severely* injured trauma patients (Table 22)By age group (3.2)

```
# ALL procs
procs <- read.csv("~/nis.00_11.allProcs.csv", header = T, stringsAsFactors = F)

procs$colTotal <- rowSums(procs[, 2:10])

procs$totProp <- round((procs$colTotal/sum(procs$colTotal)) *
    100, 2)

procs <- arrange(procs, -totProp)

head(procs)

procs[1:10, 14:16]

# get total number primary procs
proc.m <- addmargins(as.matrix(procs[1:nrow(procs), 2:12]))  # 14,219,737

# SEVERE procs

procs <- read.csv("~/nis.00_11.severeProcs.csv", header = T,
    stringsAsFactors = F)

procs$colTotal <- rowSums(procs[, 2:10])

procs$totProp <- round((procs$colTotal/sum(procs$colTotal)) *
    100, 2)

procs <- arrange(procs, -totProp)

procs[1:10, 14:16]

# get total number of severe procs
proc.m <- addmargins(as.matrix(procs[1:nrow(procs), 2:12]))
proc.m  # 3584057

3584057/14219737 * 100  # 25.20481%
```

```
# procs BY AGEGROUP
procs <- read.csv("~/nis.00_11.ageGrpProcs.csv", header = T,
    stringsAsFactors = F)

names(procs) <- c("PRCCS1", "LT18", "GT17.LT45", "GT44.LT65",
    "GT64.LT85", "GT84", "V2")
head(procs)
# younger than 18
procs <- arrange(procs, -LT18)
LT18 <- as.data.frame.matrix(procs[1:5, c(2, 7)])

LT18$AgeGroup <- "Younger than 18"
LT18$Percent <- round(LT18$LT18/sum(procs$LT18) * 100, 2)
names(LT18) <- c("Total Count", "Procedure", "AgeGroup", "Percent of Total")
LT18 <- LT18[, c(3, 2, 1, 4)]
LT18

# 17 to 45
procs <- arrange(procs, -GT17.LT45)
(GT17.LT45 <- as.data.frame.matrix(procs[1:5, c(3, 7)]))
GT17.LT45$AgeGroup <- "18 to 44"
GT17.LT45$Percent <- round(GT17.LT45$GT17.LT45/sum(procs$GT17.LT45) *
    100, 2)
names(GT17.LT45) <- c("Total Count", "Procedure", "AgeGroup",
    "Percent of Total")
GT17.LT45 <- GT17.LT45[, c(3, 2, 1, 4)]
GT17.LT45

# 45 to 65
procs <- arrange(procs, -GT44.LT65)
(GT44.LT65 <- as.data.frame.matrix(procs[1:5, c(4, 7)]))
GT44.LT65$AgeGroup <- "45 to 64"
GT44.LT65$Percent <- round(GT44.LT65$GT44.LT65/sum(procs$GT44.LT65) *
    100, 2)
names(GT44.LT65) <- c("Total Count", "Procedure", "AgeGroup",
    "Percent of Total")
GT44.LT65 <- GT44.LT65[, c(3, 2, 1, 4)]
GT44.LT65

# 65 to 85
procs <- arrange(procs, -GT64.LT85)
(GT64.LT85 <- as.data.frame.matrix(procs[1:5, c(5, 7)]))
GT64.LT85$AgeGroup <- "65 to 84"
GT64.LT85$Percent <- round(GT64.LT85$GT64.LT85/sum(procs$GT64.LT85) *
    100, 2)
names(GT64.LT85) <- c("Total Count", "Procedure", "AgeGroup",
```

```
    "Percent of Total")
GT64.LT85 <- GT64.LT85[, c(3, 2, 1, 4)]
GT64.LT85

# older than 85
procs <- arrange(procs, -GT84)
(GT84 <- as.data.frame.matrix(procs[1:5, c(6, 7)]))
GT84$AgeGroup <- "85 and Older"
GT84$Percent <- round(GT84$GT84/sum(procs$GT84) * 100, 2)
names(GT84) <- c("Total Count", "Procedure", "AgeGroup", "Percent of Total")
GT84 <- GT84[, c(3, 2, 1, 4)]
GT84

procs <- rbind(LT18, GT17.LT45, GT44.LT65, GT64.LT85, GT84)

procs

p1 <- ggplot(transform(procs, AgeGroup = factor(AgeGroup, levels = c("Younger than 18",
    "18 to 44", "45 to 64", "65 to 84", "85 and Older"))), aes(x = Procedure,
   y = Percent.of.Total))  # transforming on the fly to rearrange order of age groups and descriptions
p2 <- p1 + geom_bar(stat = "identity") + coord_flip()
p3 <- p2 + facet_grid(. ~ AgeGroup) + theme_bw()
p3

ageGrpProcPlot <- p3 + ylab("Percent of Total Age-Specific Procedures") +
    xlab("Procedure Description")
ggsave(file = "~/ageGrpEcodePlot.jpg", ageGrpProcPlot)
# ggsave(file='~/ageGrpProcPlot.jpg', ageGrpProcPlot)
```

1.8 length of stay

Aerage length of stay for all injury and trauma discharges during the study period 5.1 days (95% CI 5.0, 5.2). For severely injured patients, average length of stay was 7.5 days (95% CI 7.3, 7.7). Average length of stay varied by age group (Table 3.2) Little or no change in the average length of stay during the 12-year study period. (Table 3.2)

```
injsvy <- svydesign(id = ~HOSPID, strata = ~NIS_STRATUM, weights = ~DISCWT,
    nest = TRUE, data = inj)

mean(inj$LOS, na.rm = T)

svymean(~LOS, injsvy, na.rm = T, multicore = T)

confint(svymean(~LOS, injsvy, na.rm = T, multicore = T))

los1 <- svyby(~LOS, ~severe, injsvy, svymean, keep.var = TRUE,
```

```
    na.rm = T, multicore = T)
los1

confint(los1)

los2 <- svyby(~LOS, ~ageGrp.num, injsvy, svymean, keep.var = TRUE,
    na.rm = T, multicore = T)
los2

confint(los2)

los3 <- svyby(~LOS, ~YEAR, injsvy, svymean, keep.var = TRUE,
    na.rm = T, multicore = T)
los3

confint(los3)

los4 <- svyby(~LOS, ~YEAR + ageGrp.num, injsvy, svymean, keep.var = TRUE,
    na.rm = T, multicore = T)
los4

confint(los4)
```

2 logistic regression inpatient mortality

Tables 24 and ??

```
CFR.glm <- svyglm(DIED ~ YEAR + AGE + FEMALE + HOSP_TEACH + AWEEKEND +
    level.one + severe + Charlson, injsvy, family = binomial(logit))

summary(CFR.glm)

round(exp(cbind(OR = coef(CFR.glm), confint(CFR.glm))), 3)[-1,
    ]

expo.CFR.mod <- exp(cbind(OR = coef(CFR.glm), confint(CFR.glm)))

expo.CFR.mod

round(expo.CFR.mod, 2)

xtable(round(expo.CFR.mod, 2))

stargazer(CFR.glm)
```

3 Figures and Tables

3.1 Figures

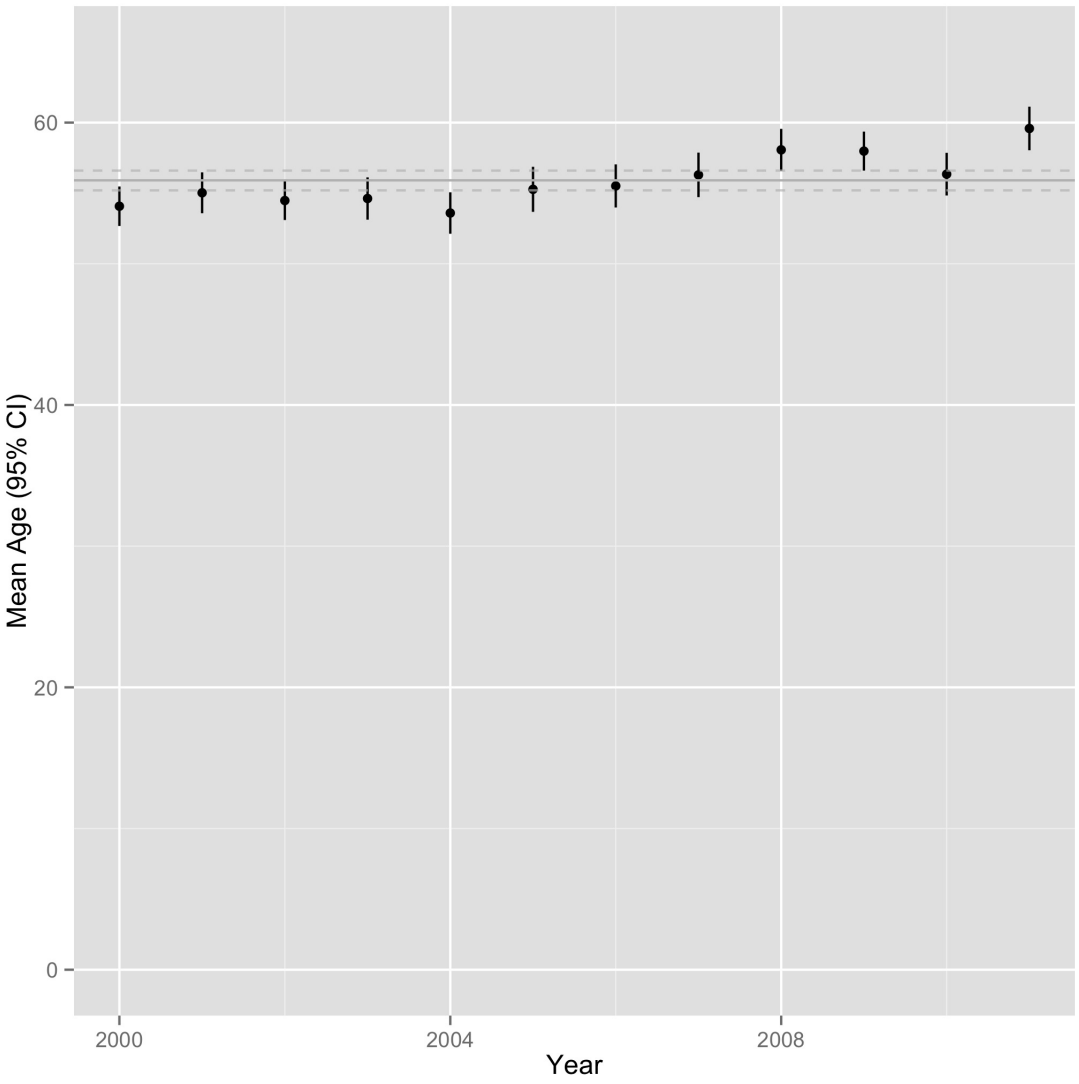

Figure 1: Mean Age of Inpatient Trauma Discharges, United States Hospitals, 2000 to 2011

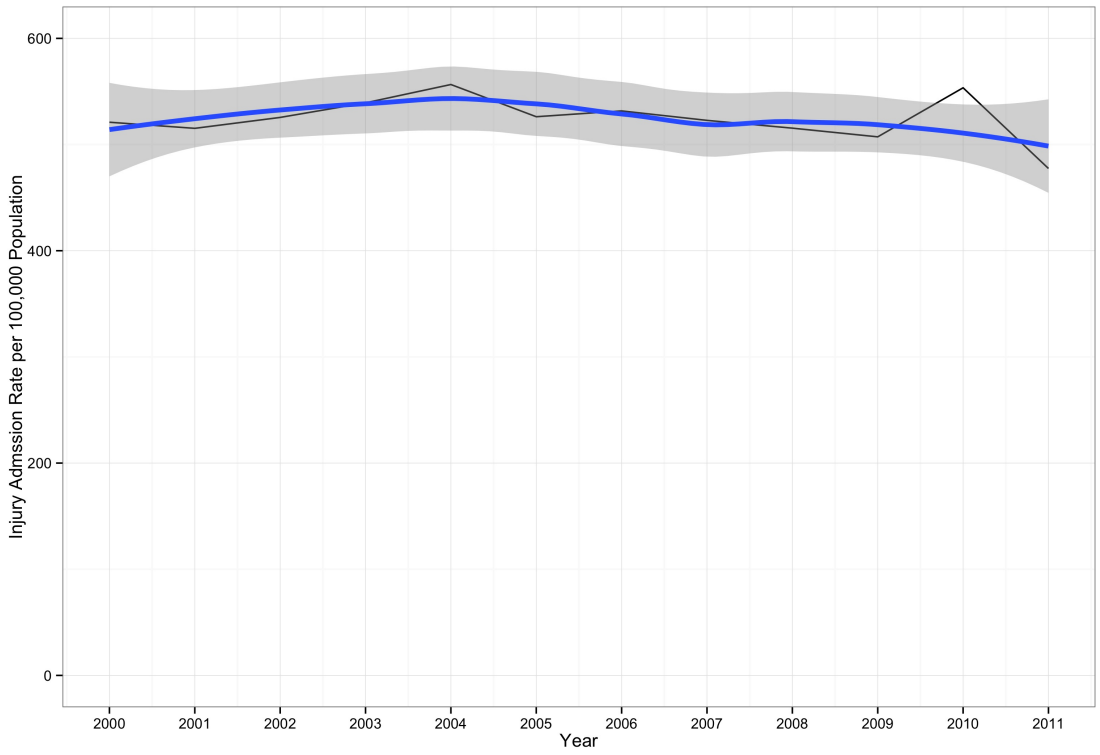

Figure 2: Annual Injury Hospital Admission Rates per 100,000 Population with Overlying Loess Smoothing line and Confidence Envelope. United States, 2000-2011.

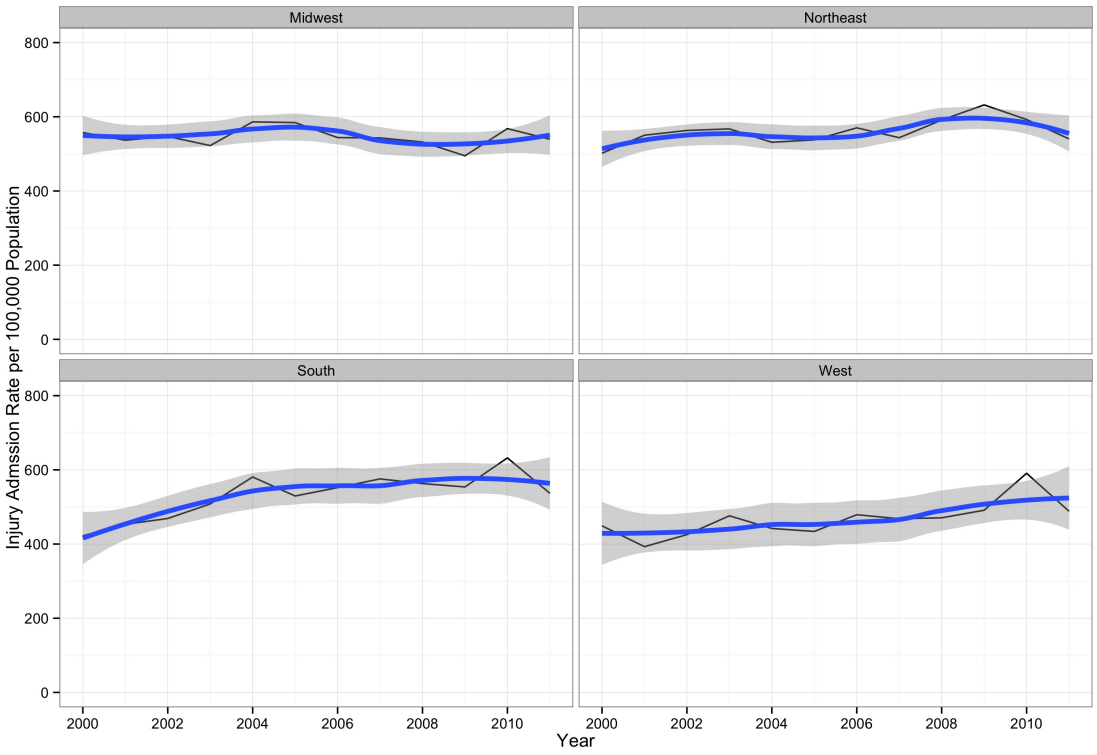

Figure 3: Annual Injury Hospital Admission Rates per 100,000 Population with Overlying Loess Smoothing line and Confidence Envelope. United States Census Regions, 2000-2011.

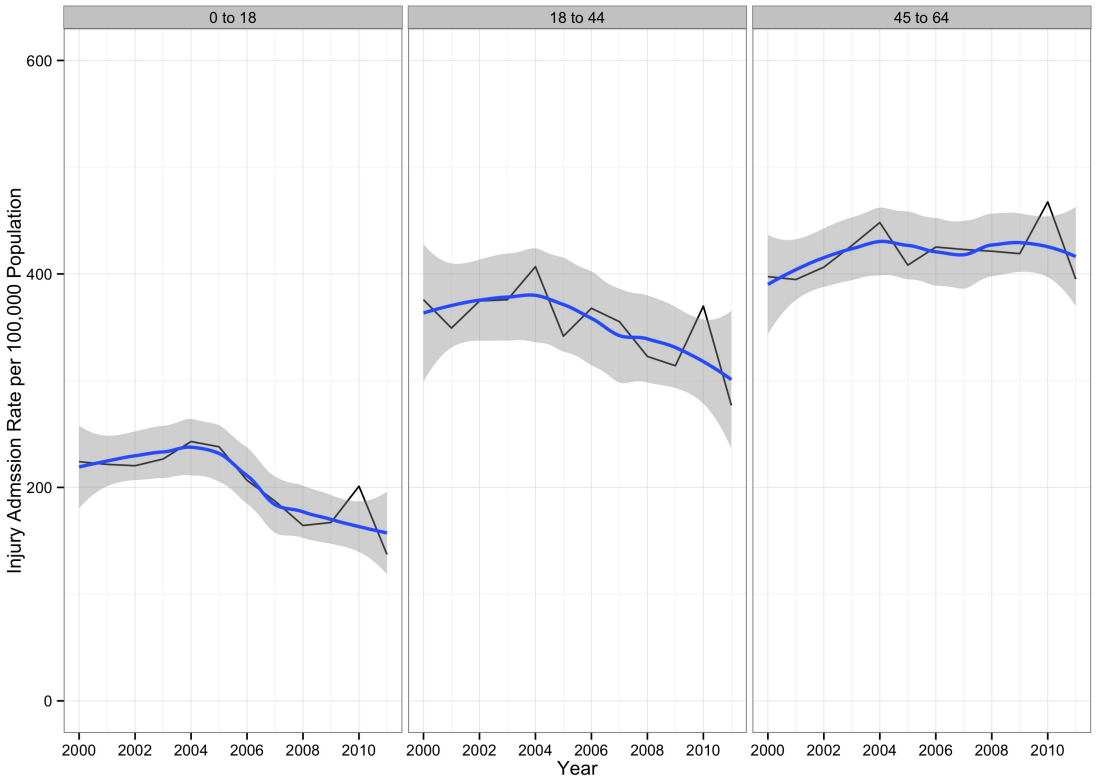

Figure 4: Annual Injury Hospital Admission Rates per 100,000 Population with Overlying Loess Smoothing line and Confidence Envelope. Children and Young Adults. United States, 2000-2011.

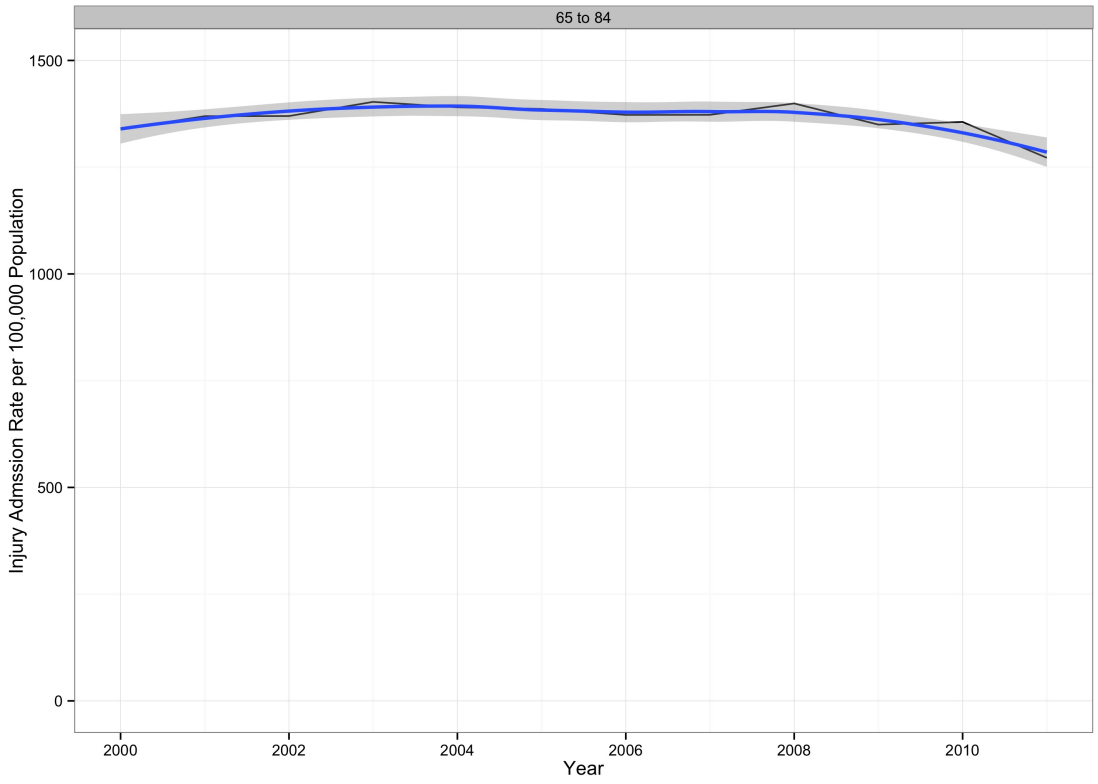

Figure 5: Annual Injury Hospital Admission Rates per 100,000 Population with Overlying Loess Smoothing line and Confidence Envelope. Adults Ages 65 to 85. United States, 2000-2011.

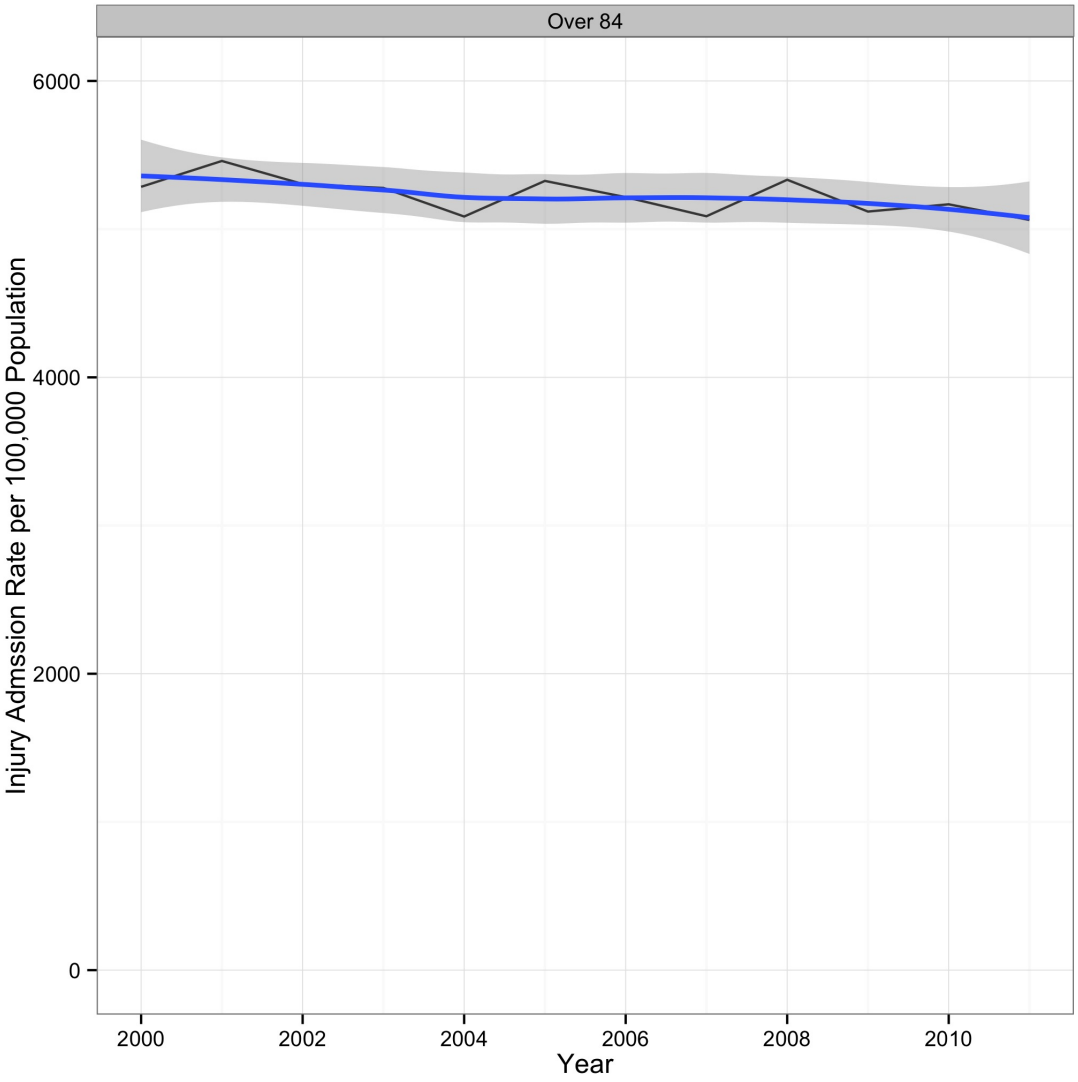

Figure 6: Annual Injury Hospital Admission Rates per 100,000 Population with Overlying Loess Smoothing line and Confidence Envelope. Adults Older than 84. United States, 2000-2011.

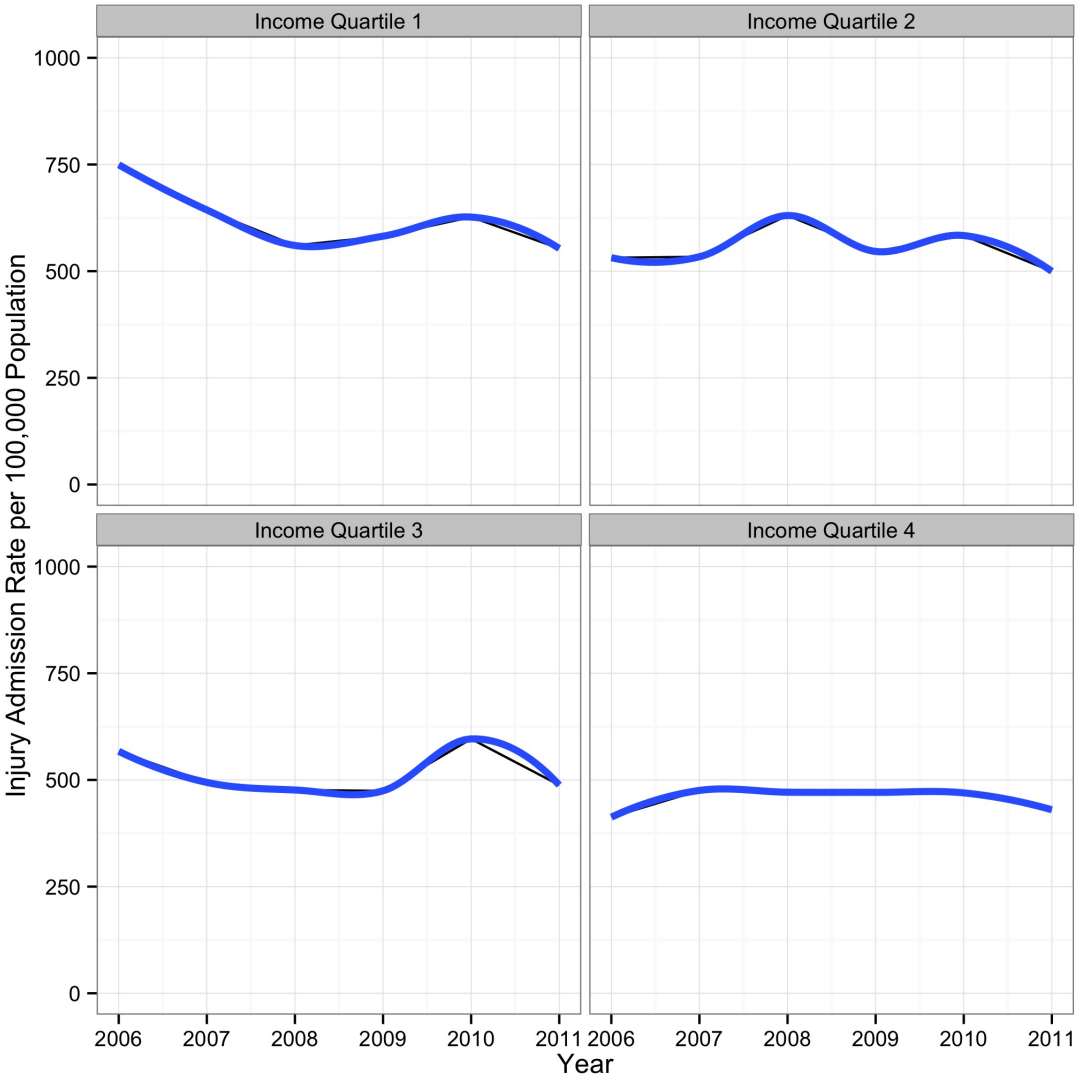

Figure 7: Injury Admission Rates by Income Quartile

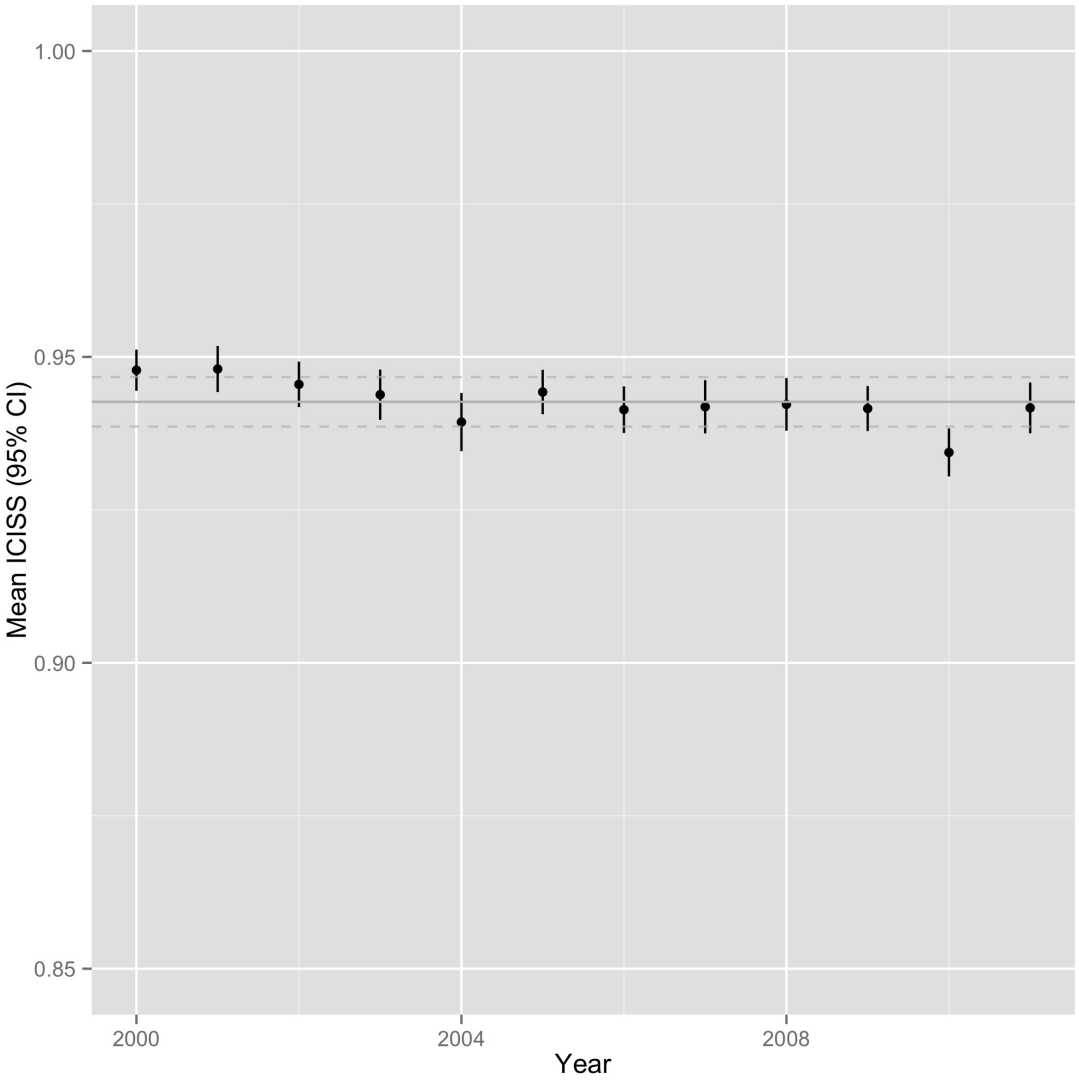

Figure 8: Mean ICISS Over Time

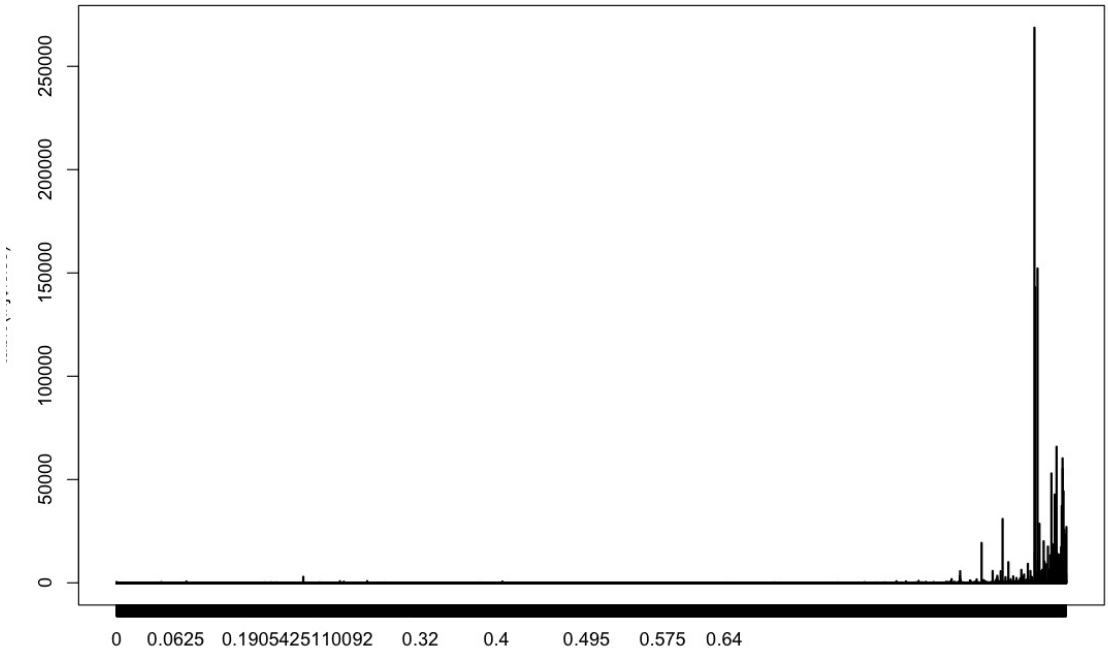

Figure 9: ICISS

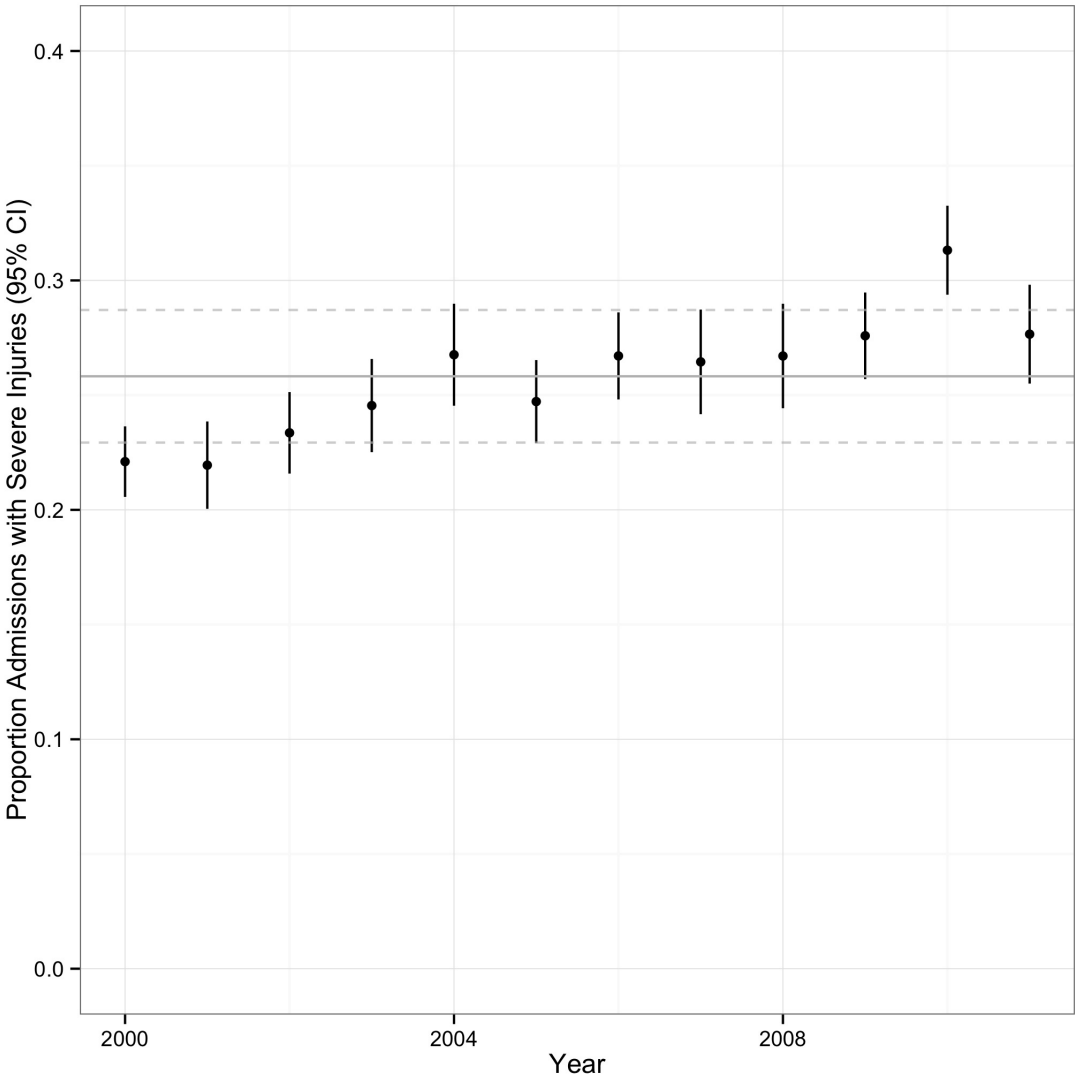

Figure 10: Annual Proportion of Hospital Admissions Classified as Severe. United States, 2000 to 2011.

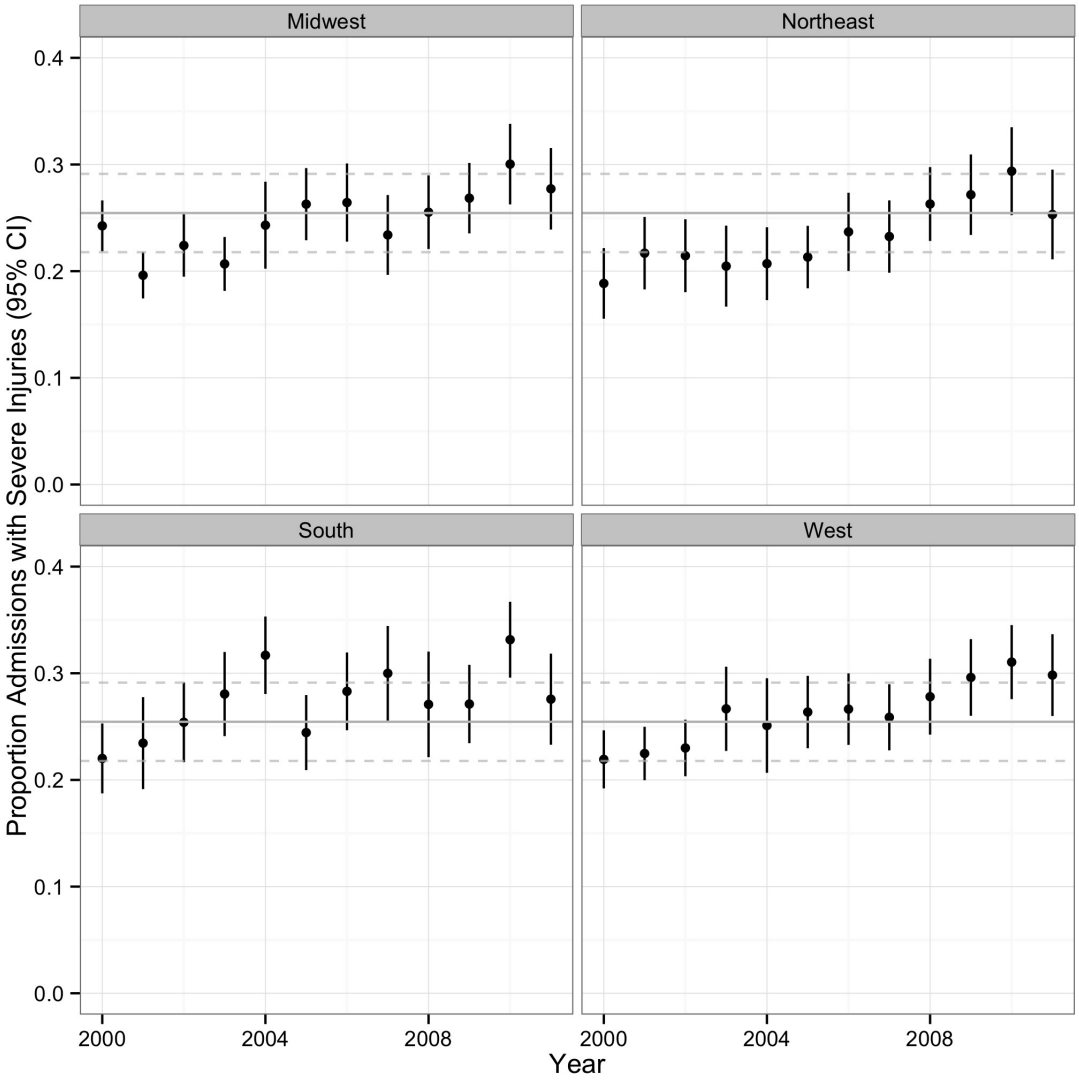

Figure 11: Annual Proportion of Hospital Admissions Classified as Severe. Census Regions of the United States, 2000 to 2011.

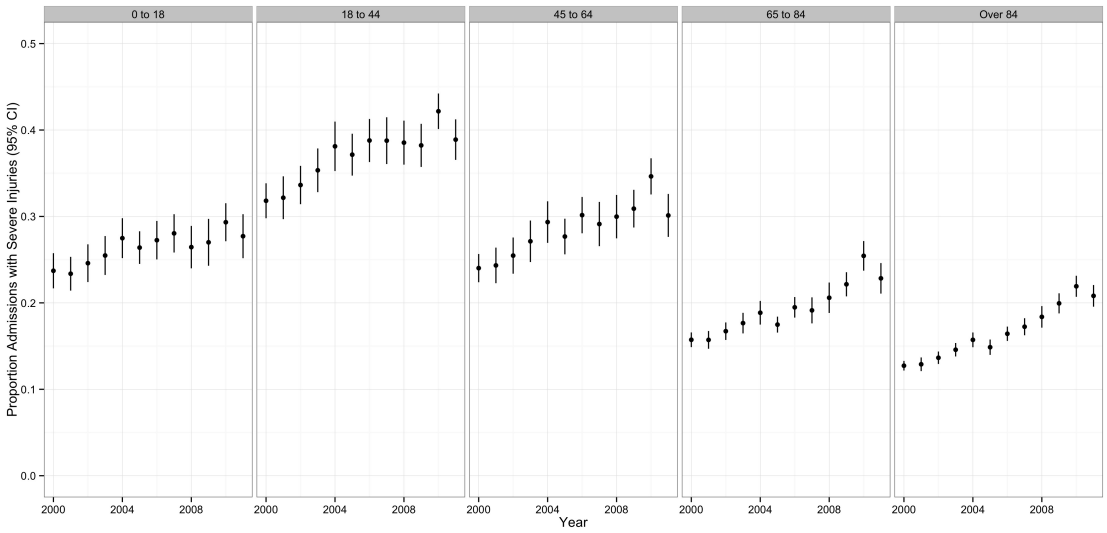

Figure 12: Proportion of Severe Injuries Over Time, by Age Group.

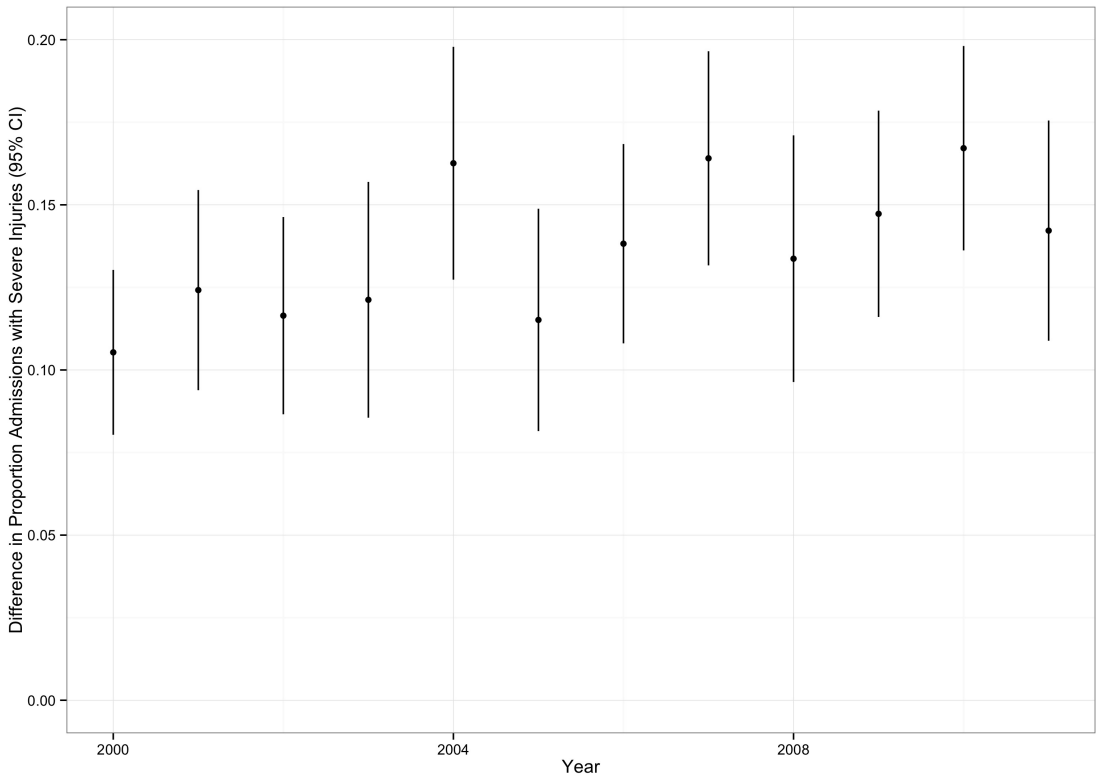

Figure 13: Annual Difference in Proportion of Injury Admission Classified as Severe Admitted to Teaching Hospitals vs Non-Teaching Hospitals, US Hospitals, 2000-2011.

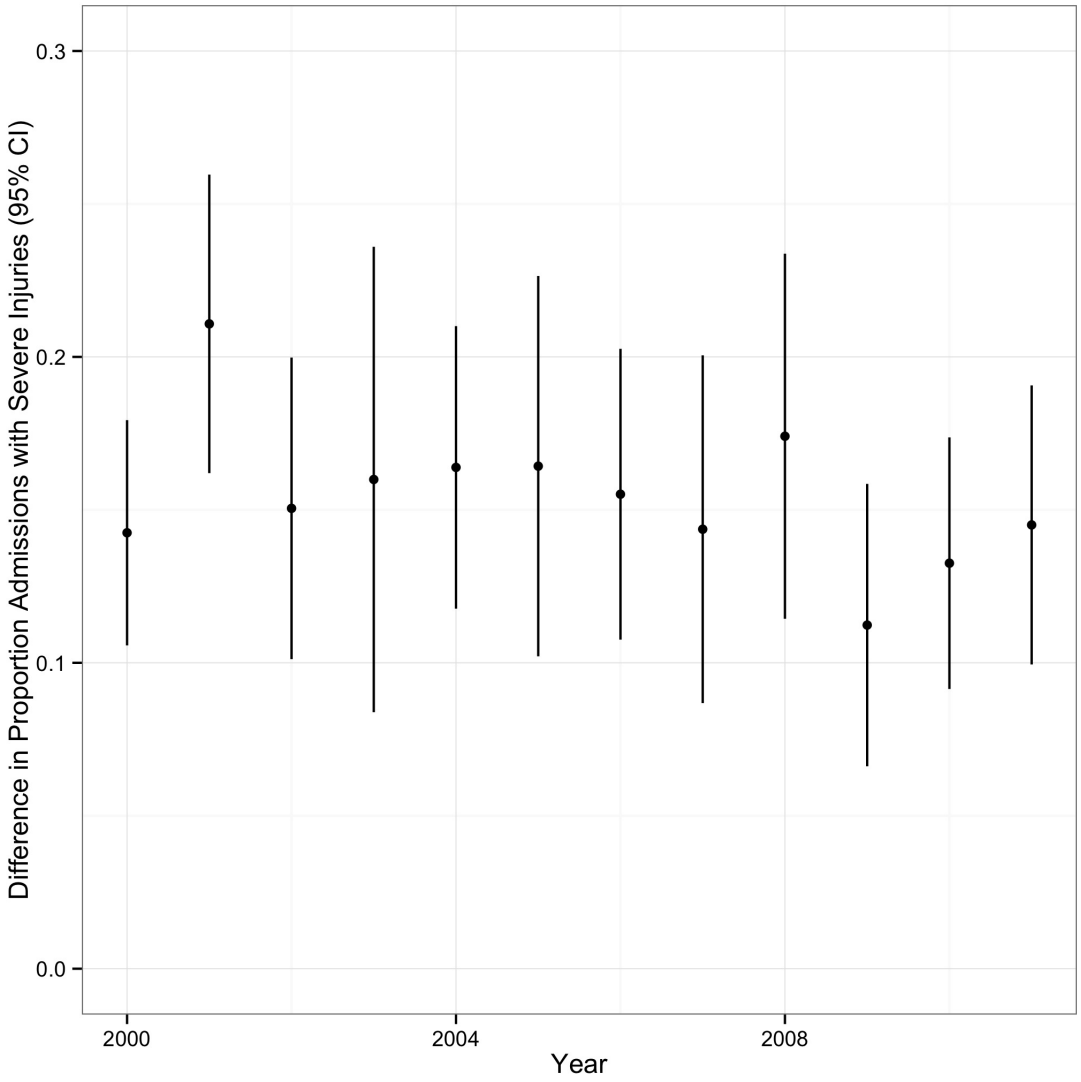

Figure 14: Annual Proportion Difference Severely Injured Patients Treated at Level-One Trauma Centers vs. Non-Level-One Trauma Centers. US Hospitals, 2000-2011.

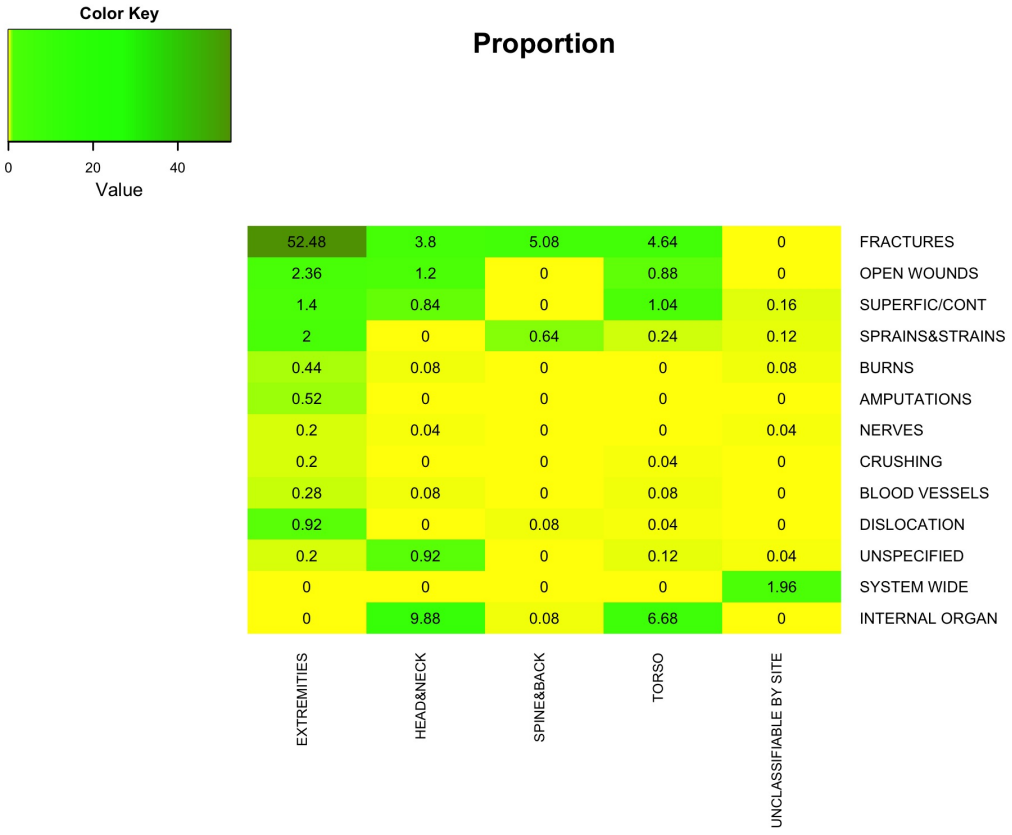

Figure 15: Heat Map Barrel Matrix by Total Proportion Table of United States Hosptial Trauma Admissions, 2000-2011

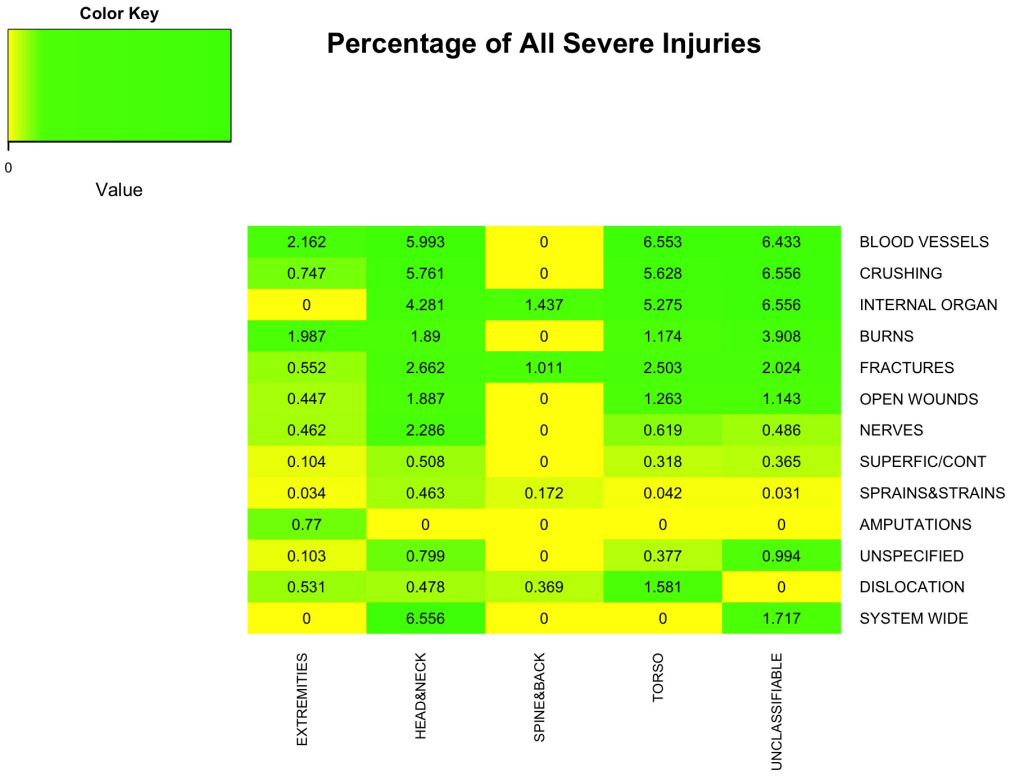

Figure 16: Heat Map Barrel Matrix Proportion of Severe Injuries. United States Hosptial Trauma Admissions, 2000-2011

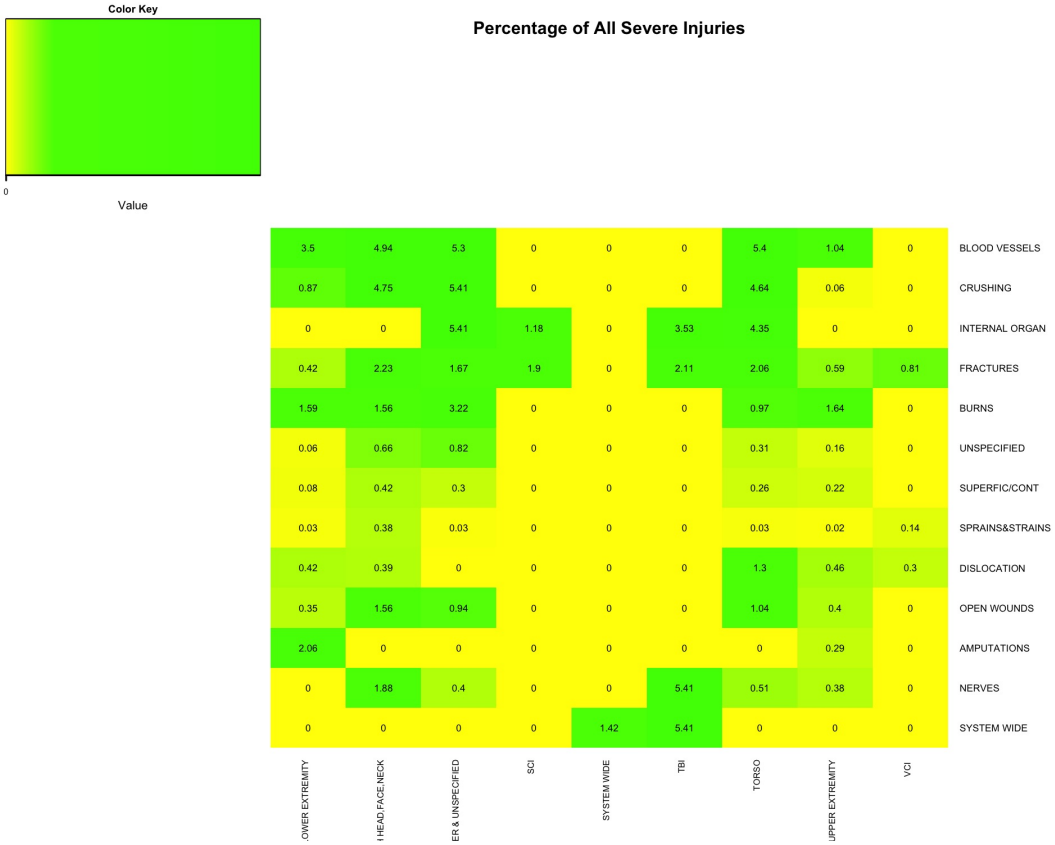

Figure 17: Heat Map Barrel Matrix Proportion of Severe Injuries (2). United States Hosptial Trauma Admissions, 2000-2011

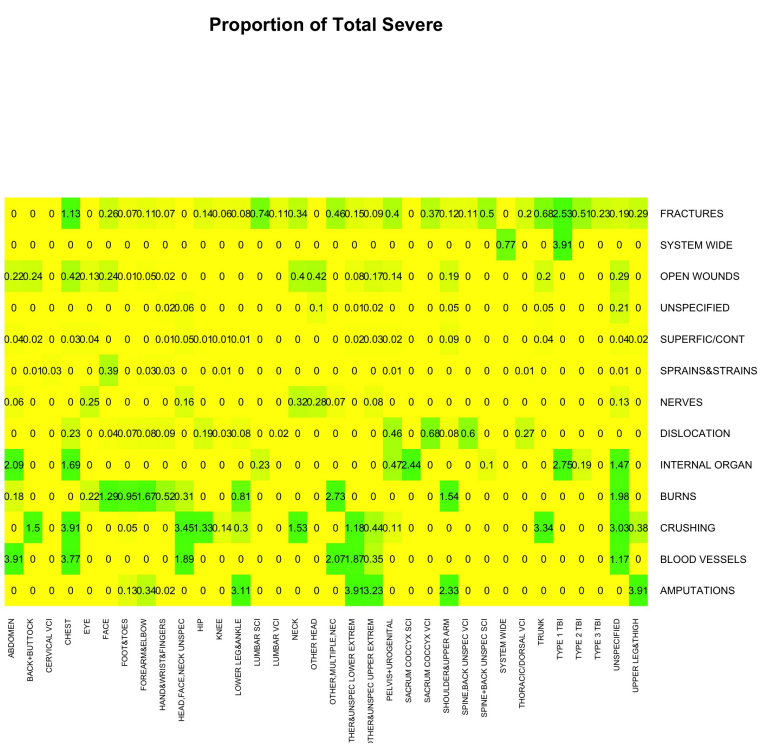

Figure 18: Heat Map Barrel Matrix Proportion of Severe Injuries (2). United States Hosptial Trauma Admissions, 2000-2011

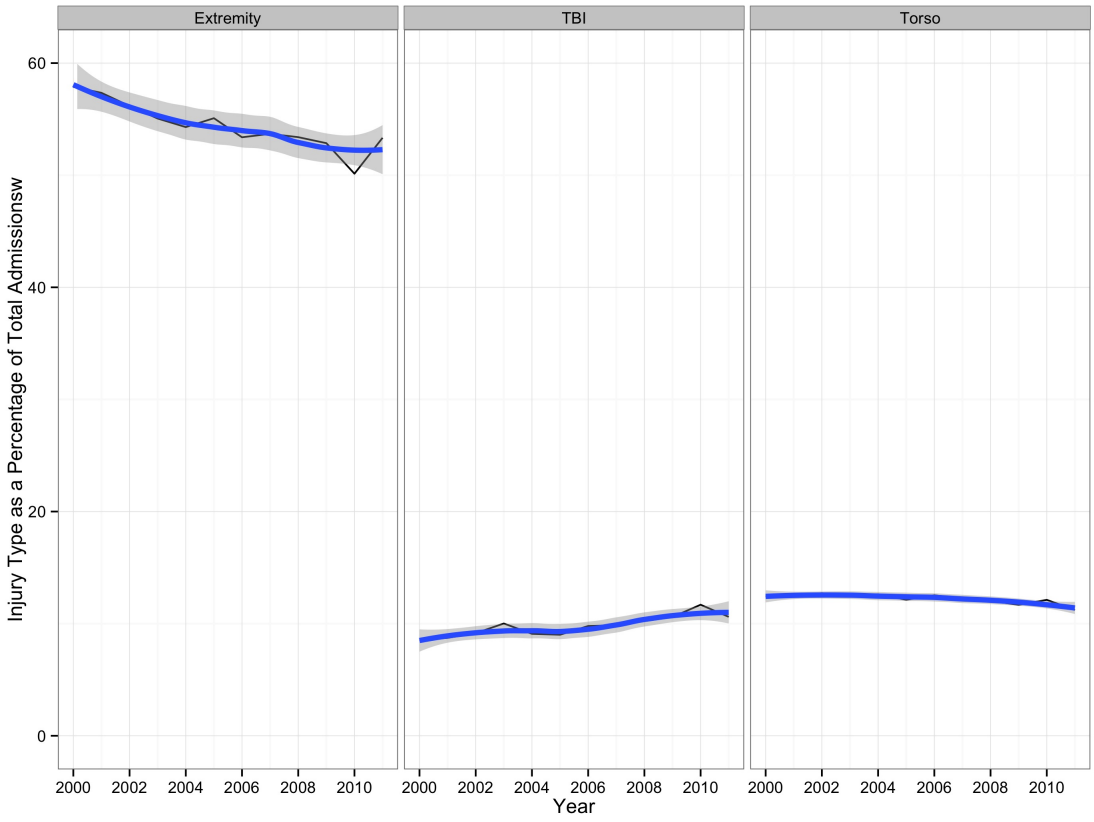

Figure 19: Percentage of Annual Admissions by Injury Type. US Hospitals 2000-2011

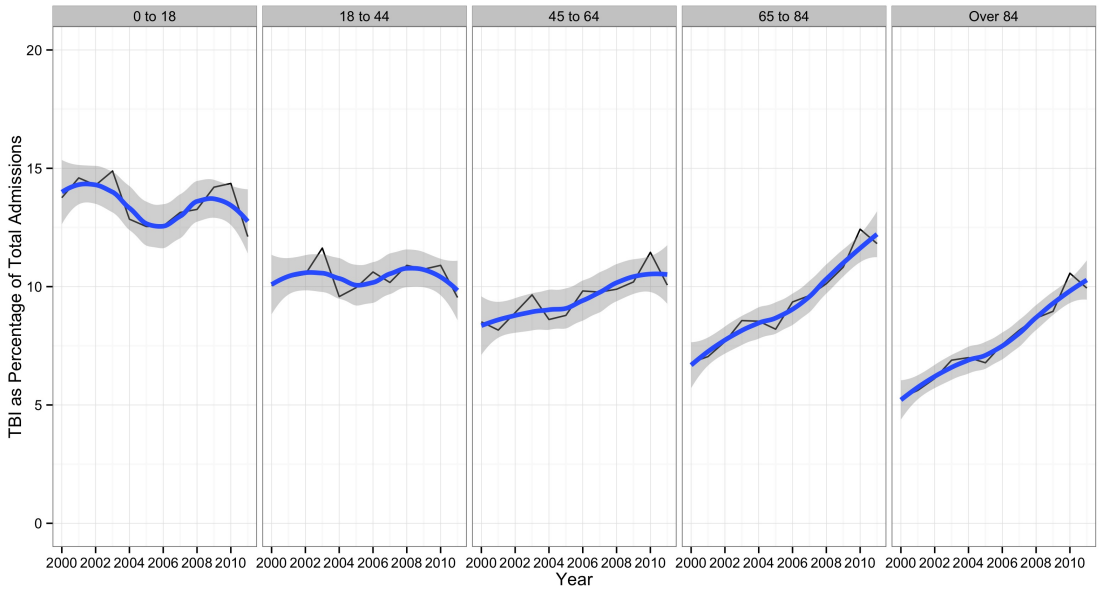

Figure 20: Percentage TBI of Annual Admissions by Age Group. US Hospitals 2000-2011

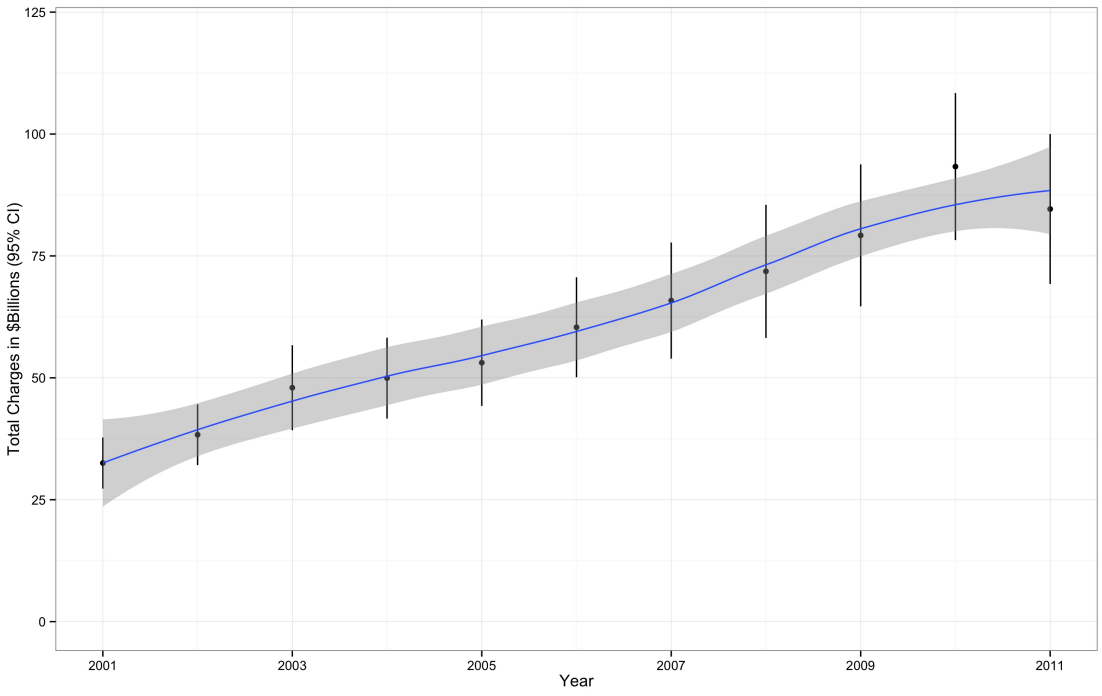

Figure 21: Annual Total Injury-Related Inpatient Charges, US Hospitals, 2001-2011 95% Confidence Limits, Smoothed Loess Trend Line with 95% Confidence Envelope.

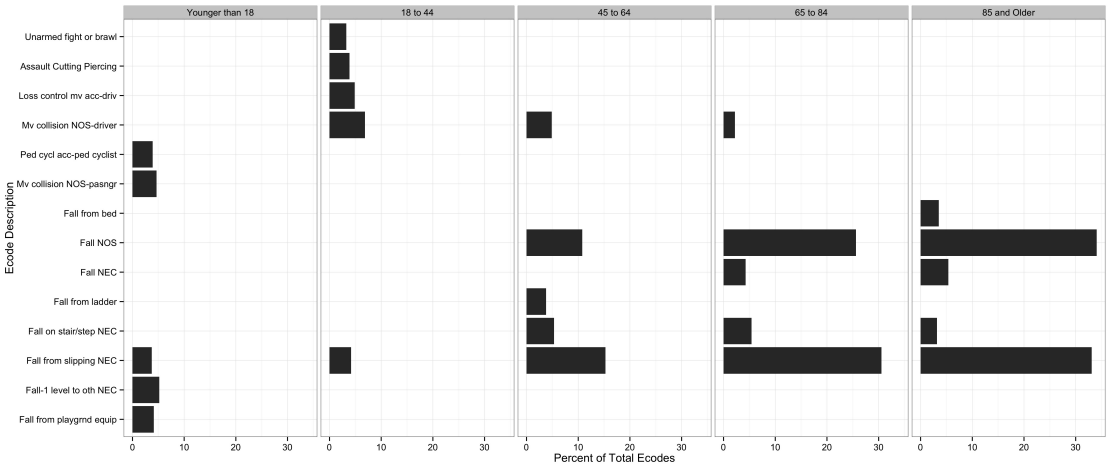

Figure 22: Ecode Injury Mechanisms by Age Group. Inpatient Trauma Discharges, US Hospitals, 2003-2011.

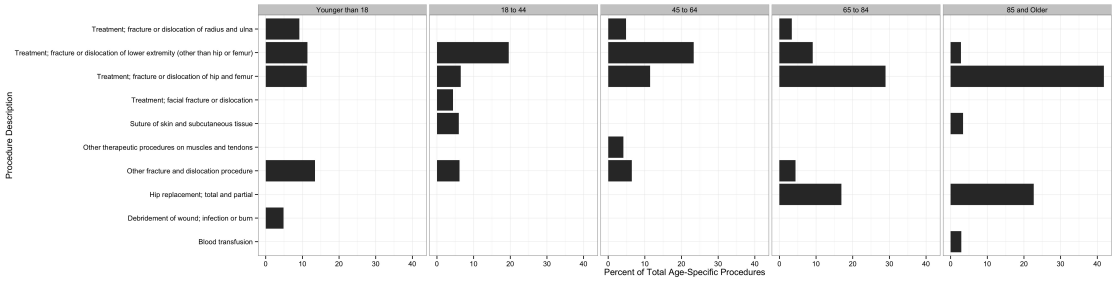

Figure 23: caption

3.2 Tables

Year	Mean Age (se)
2000	54.08 (0.71)
2001	55.03 (0.74)
2002	54.48 (0.70)
2003	54.62 (0.76)
2004	53.60 (0.75)
2005	55.27 (0.81)
2006	55.51 (0.78)
2007	56.30 (0.80)
2008	58.07 (0.76)
2009	57.98 (0.70)
2010	56.35 (0.77)
2011	35719(2837)

Table 1: Mean Age of Inpatient Trauma Patients, US Hospitals, 2000-2011.

Table 2: Simple Linear Regression Model for the Association of Region with Inpatient Trauma Discharge Rate. Inpatient Trauma Patients, US Hospitals, 2000-2011.

	Dependent variable:
	Rate
Year	−1.412
	(2.737)
RegionNortheast	−13,183.960*
	(7,763.334)
RegionSouth	−29,130.870***
	(7,763.334)
RegionWest	−22,318.780***
	(7,763.334)
Year:RegionNortheast	6.581*
	(3.871)
Year:RegionSouth	14.518***
	(3.871)
Year:RegionWest	11.089***
	(3.871)
Constant	3,378.454
	(5,489.506)
Observations	48
R^2	0.705
Adjusted R^2	0.654
Residual Std. Error	32.732 (df = 40)
F Statistic	13.682*** (df = 7; 40)
Note:	*p<0.1; **p<0.05; ***p<0.01

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-1.4698	0.0273	-53.82	0.0000
HOSP_TEACH	0.7436	0.0441	16.87	0.0000

Table 3: Results of survey-adjusted logistic regression model for the association of severe injuries with teaching hospitals, US hospitals, 2000-2011.

Year	Number of Deaths (se)
2000	34496(2379)
2001	35281(2459)
2002	37363(2618)
2003	38527(2844)
2004	42082(3442)
2005	36353(2554)
2006	38395(2821)
2007	37479(2992)
2008	36697(2714)
2009	35499(2532)
2010	43162(3445)
2011	35719(2837)

Table 4: Annual Number of Trauma-Related Inpatient Deaths. US Hospitals, 2000-2011.

Year	Case Fatality Ratio (se)
2000	0.0240 (0.0006)
2001	0.0249 (0.0007)
2002	0.0249 (0.0007)
2003	0.0258 (0.0007)
2004	0.0234 (0.0009)
2005	0.0242 (0.0007)
2006	0.0238 (0.0007)
2007	0.0234 (0.0007)
2008	0.0228 (0.0006)
2009	0.0252 (0.0006)
2010	0.0235 (0.0007)
2011	0.0235 (0.0007)

Table 5: Annual Inpatient Case Fatality Ratio Trauma-Related Inpatient Admissions. US Hospitals, 2000-2011.

Year	ICISS (se)
2000	0.964 (0.001)
2001	0.964 (0.001)
2002	0.962 (0.001)
2003	0.961 (0.001)
2004	0.958 (0.002)
2005	0.962 (0.001)
2006	0.960 (0.001)
2007	0.959 (0.001)
2008	0.960 (0.001)
2009	0.959 (0.001)
2010	0.954 (0.001)
2011	0.957 (0.002)

Table 6: Mean ICD9 Derived Injury Severity Score by Year. Inpatient Trauma Discharges, US Hospitals, 2000-2011.

	Year	Proportion Severe	se	Upper 95%	Lower 95%
2000	2000	0.22	0.01	0.24	0.21
2001	2001	0.22	0.01	0.24	0.20
2002	2002	0.23	0.01	0.25	0.22
2003	2003	0.25	0.01	0.27	0.23
2004	2004	0.27	0.01	0.29	0.25
2005	2005	0.25	0.01	0.27	0.23
2006	2006	0.27	0.01	0.29	0.25
2007	2007	0.26	0.01	0.29	0.24
2008	2008	0.27	0.01	0.29	0.24
2009	2009	0.28	0.01	0.29	0.26
2010	2010	0.31	0.01	0.33	0.29
2011	2011	0.28	0.01	0.30	0.26

Table 7: Annual Proportion of Admissions Classified as Severe. Inpatient Trauma Discharges, US Hospitals, 2000-2011.

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-12.7025	3.2446	-3.92	0.0003
YEAR	0.0065	0.0016	3.99	0.0003
regionNortheast	-2.4505	4.5885	-0.53	0.5963
regionSouth	2.1548	4.5885	0.47	0.6412
regionWest	-2.3594	4.5885	-0.51	0.6099
YEAR:regionNortheast	0.0012	0.0023	0.53	0.5985
YEAR:regionSouth	-0.0011	0.0023	-0.46	0.6451
YEAR:regionWest	0.0012	0.0023	0.52	0.6076

Table 8: Regression Analysis, Association of Region of United States with Injury Severity. Inpatient Trauma Discharges, US Hospitals, 2000-2011.

	Age Group	Proportion Severe (se)
0 to 18	0.155 (0.004)	
18 to 44	0.199 (0.004)	
45 to 64	0.162 (0.004)	
65 to 84	0.114 (0.002)	
Over 84	0.091 (0.002)	

Table 9: Proportion of Severely Injured Trauma Patients by Age Group. Inpatient Trauma Discharges, US Hospitals, 2000-2011.

Coefficient	Estimate (se)	p value
Intercept	0.418 (0.009)	0.001
Age Group	-0.050 (0.001)	0.001

Table 10: Regression Results, Generalized Linear Model, Association of Age Group with Proportion of Severely Injured Admitted Trauma Patients. US Hospitals 2000-2011

	Age Group	Proportion Severe (se)
Less than 18	1.00	0.26 (0.01)
18 to 44	2.00	0.37 (0.01)
45 to 64	3.00	0.29 (0.01)
65 to 84	4.00	0.19 (0.00)
85 and Older	5.00	0.17 (0.00)

Table 11: Proportion of Trauma and Injury Admissions Classified as Severe by Age Group. US Hospitals 2000-2011

Income Quartile	Proportion Severe (se)
1	0.289 (0.010)
2	0.278 (0.006)
3	0.274 (0.007)
4	0.261 (0.009)

Table 12: Proportion of Severely Injured Trauma Patients by Income Quartile. Inpatient Trauma Discharges, US Hospitals, 2000-2011.

Table 13: Regression Results, Generalized Linear Model, Association of Income Quartile with Proportion of Severe Injuries.US Hospitals, 2000-2011.

	Dependent variable:
	severe
Income Quartile	-0.009^{**}
	(0.004)
Constant	0.297^{***}
	(0.012)
Observations	2,078,908
Log Likelihood	−1,281,812.000
Akaike Inf. Crit.	2,563,628.000
Note:	*p<0.1; **p<0.05; ***p<0.01

Injury Type	Frequency (se)	Proportion (95% CI)
Amputations	88177.28 (4340.67)	0.47 (0.43 , 0.52)
Blood Vessels	91243.93 (4631.76)	0.49 (0.44 , 0.54)
Burns	391240.10 (34776.97)	2.09 (1.73 , 2.46)
Crushing	56303.00 (2707.63)	0.30 (0.27 , 0.33)
Dislocation	198694.05 (4698.86)	1.06 (1.01 , 1.11)
Fractures	12202924.79 (242422.49)	65.31 (62.77 , 67.86)
Internal Organ	2905055.01 (98283.12)	15.55 (14.52 , 16.58)
Nerves	45606.02 (3146.08)	0.24 (0.21 , 0.28)
Open Wounds	967321.68 (32314.16)	5.18 (4.84 , 5.52)
Sprains&Strains	542024.03 (12358.74)	2.90 (2.77 , 3.03)
Superfic/Cont	593656.99 (12505.98)	3.18 (3.05 , 3.31)
System Wide	347275.51 (8980.43)	1.86 (1.76, 1.95)
Unspecified	254268.19 (7932.85)	1.36 (1.28, 1.44)

Table 14: Frequency and Proportion of Injury Types. United States Hosptial Trauma Admissions, 2000-2011

	Extremities	Head&Neck	Spine&Back	Torso	Unclassifiable	Sum
Amputations	88177	0	0	0	0	88177
Blood Vessels	44277	15100	0	13555	2411	75343
Burns	76178	13080	0	468	13838	103564
Crushing	34545	1222	0	6196	499	42461
Dislocation	149920	2098	15618	5196	86	172918
Fractures	8727070	634971	843647	773693	1228	10980609
Internal Organ	0	1645286	10170	1111390	1164	2768010
Nerves	31326	4350	0	988	8715	45379
Open Wounds	394626	200349	0	144051	1976	741003
Sprains&Strains	332773	130	109686	37677	18009	498274
Superfic/Cont	233602	136366	0	170197	26891	567057
System Wid	e	[redacted]	0		5 0 0	324466 324471
Unspecified	35879	151930	0	19713	9700	217222
Sum	10148373	2804887	979121	2283123	408984	16624488

Table 15: Barrel Matrix Frequency Table. United States Hosptial Trauma Admissions, 2000-2011

Injury Location	Frequency (se)	Proportion (95% CI)
Abdomen	648607 (25882)	3.90 (3.60 , 4.21)
Back&Buttock	58974 (1624)	0.35 (0.34 , 0.37)
Cervical VCI	49231 (2729)	0.30 (0.26 , 0.33)
Chest	710065 (22301)	4.27 (4.01 , 4.53)
Eye	89631 (3646)	0.54 (0.50 , 0.58)
Face	469827 (18697)	2.83 (2.61 , 3.05)
Foot&Toes	344012 (8991)	2.07 (1.96 , 2.18)
Forearm&Elbow	737170 (18071)	4.43 (4.22 , 4.65)
Hand&Wrist&Fingers	461552 (19082)	2.78 (2.55 , 3.00)
Head,Face,Neck Unspec	143864 (4349)	0.87 (0.81 , 0.92)
Hip	3859210 (65077)	23.21 2(2.45 ,23.98)
Knee	291599 (5880)	1.75 (1.68 , 1.82)
Lower leg&Ankle	2146803 (45228)	12.91 1(2.38 ,13.45)
Lumbar SIC	18910 (867)	0.11 (0.10 , 0.12)
Lumbar VCI	523210 (10572)	3.15 (3.02 , 3.27)
Neck	43344 (1992)	0.26 (0.24 , 0.28)
Other Head	227145 (7549)	1.37 (1.28 , 1.46)
Other,Multiple,NEC	11260 (666)	0.07 (0.06 , 0.08)
Other Unspec Lower Extrem	317715 (7075)	1.91 (1.83 , 1.99)
Other Unspec Upper Extrem	78418 (4674)	0.47 (0.42 , 0.53)
Pelvis+Urogenital	831138 (17505)	5.00 (4.79 , 5.21)
Sacrum Coccyx SCI	360 (42)	0.00 (0.00 , 0.00)
Sacrum Coccyx VCI	74885 (2063)	0.45 (0.43 , 0.47)
Shoulder&Upper Arm	1197305 (24113)	7.20 (6.92 , 7.49)
Spine,Back Unspec VCI	5319 (268)	0.03 (0.03 , 0.04)
Spine,Back Unspec SCI	6943 (365)	0.04 (0.04 , 0.05)
System Wide	324465 (7760)	1.95 (1.86 , 2.04)
Thoracic/Dorsal VCI	300259 (7017)	1.81 (1.72 , 1.89)
Trunk	34337 (1594)	0.21 (0.19 , 0.23)
Type 1 TBI	1253983 (42052)	7.54 (7.05 , 8.04)
Type 2 TBI	488694 (23571)	2.94 (2.66 , 3.22)
Type 3 TBI	88393 (3426)	0.53 (0.49 , 0.57)
Unspecified	73257 (3935)	0.44 (0.39 , 0.49)
Upper leg&Thigh	714585 (17263)	4.30 (4.09 4.50)

Table 16: Anatomical Location Frequencies and Overall Proportions Injuries Admitted to US Hospitals 2000 - 2011.

	Lower Extremity	Upper Ext	Head, Face, Neck	Torso	Spine	Vertebrae	TBI	Systemwide	Unspecified	Total
Amputations	16724	71454	0	0	0	0	0	0	0	88178
Blood Vessels	13300	30978	15100	13555	0	0	0	0	2411	75344
Burns	8263	67915	13080	468	0	0	0	0	13838	103564
Crushing	23446	11099	1222	6196	0	0	0	0	499	42462
Dislocation	86570	63350	2098	5196	0	15618	0	0	86	172918
Fractures	6888480	1838590	449201	773693	16044	827603	185770	0	1228	10980609
Internal Organ	0	0	0	1111390	10170	0	1645286	0	1164	2768010
Nerves	0	31326	4339	988	0	0	11	0	8715	45379
Open Wounds	219494	175132	200349	144051	0	0	0	0	1976	741002
Sprains & Strains	173283	159490	130	37677	0	109686	0	0	18009	498275
Superfic Cont	217637	15965	136366	170197	0	0	0	0	26891	567056
System Wide	0	0	0	0	0	0	5	324466	0	324471
Unspecified	26731	9148	151930	19713	0	0	0	0	9700	217222
Total	7673928	2474447	973815	2283124	26214	952907	1831072	324466	84517	16624490

Table 17: Barell Matrix 2nd Level Anatomical Location and Type of Injury Cross Tabulation Frequencies, Injuries Admitted to US Hospitals 2000 - 2011.

Ecode	Description	Total Count	Percent of Total
885.9	Fall from slipping NEC	2646933	18.81
E888.9	Fall NOS	2288542	16.26
E880.9	Fall on stair/step NEC	542571	3.85
E812.0	Mv collision NOS-driver	503106	3.57
E888.8	Fall NEC	392894	2.79
E884.9	Fall-1 level to oth NEC	329418	2.34
E816.0	Loss control mv acc-driv	283703	2.02
E928.9	Accident NOS	264799	1.88
E812.1	Mv collision NOS-pasngr	235812	1.68
E881.0	Fall from ladder	234318	1.66
E884.4	Fall from bed	219240	1.56

Table 18: Top 10 Injury Mechanisms, All Injury and Trauma Hospital Discharges, US Hospitals, 2003-2011.

Ecode	Description	Total Count	Percent of Total
E888.9	Fall NOS	397067	10.42
E885.9	Fall from slipping NEC	323493	8.49
E812.0	Mv collision NOS-driver	278624	7.31
E816.0	Loss control mv acc-driv	174610	4.58
E880.9	Fall on stair/step NEC	137559	3.61
E812.1	Mv collision NOS-pasngr	136054	3.57
E814.7	Mv coll w pedest-pedest	106253	2.79
E966.0	Assault Cutting Piercing	97787	2.57
E884.9	Fall-1 level to oth NEC	85514	2.24
E812.2	Mv collis NOS-motorcycl	72230	1.89
E881.0	Fall from ladder	67061	1.76

Table 19: Top 10 Injury Mechanisms, Severe Injury and Trauma Hospital Discharges, US Hospitals, 2003-2011.

AgeGroup	Ecode	Description	Total Count	Percent of Total
Younger than 18	E884.9	Fall-1 level to oth NEC	66039	5.18
	E812.1	Mv collision NOS-pasngr	59282	4.65
	E884.0	Fall from playgrnd equip	52335	4.11
	E826.1	Ped cycl acc-ped cyclist	49684	3.90
	E885.9	Fall from slipping NEC	47747	3.75
18 to 44	E812.0	Mv collision NOS-driver	240000	6.87
	E816.0	Loss control mv acc-driv	169912	4.86
	E885.9	Fall from slipping NEC	145362	4.16
	E966.0	Assault Cutting Piercing	134566	3.85
	E960.0	Unarmed fight or brawl	113261	3.24
45 to 64	E885.9	Fall from slipping NEC	439800	15.26
	E888.9	Fall NOS	310644	10.78
	E880.9	Fall on stair/step NEC	153398	5.32
	E812.0	Mv collision NOS-driver	140980	4.89
	E881.0	Fall from ladder	108330	3.76
65 to 84	E885.9	Fall from slipping NEC	1227898	30.54
	E888.9	Fall NOS	1030323	25.63
	E880.9	Fall on stair/step NEC	217820	5.42
	E888.8	Fall NEC	170919	4.25
	E812.0	Mv collision NOS-driver	87655	2.18
85 and Older	E888.9	Fall NOS	805236	34.05
	E885.9	Fall from slipping NEC	782996	33.11
	E888.8	Fall NEC	126996	5.37
	E884.4	Fall from bed	83642	3.54
	E880.9	Fall on stair/step NEC	75222	3.18

Table 20: Top 5 Injury Mechanisms by Age Group, Inpatient Trauma Discharges, US Hospitals, 2003-2011.

Rank	Procedure	Frequency	Proportion
1	Treatment; fracture or dislocation of hip and femur	2296481	19.89
2	Treatment; fracture or dislocation of lower extremity (other than hip or femur)	1638993	14.20
3	Hip replacement; total and partial	1034997	8.96
4	Other fracture and dislocation procedure	658713	5.71
5	Treatment; fracture or dislocation of radius and ulna	505480	4.38
6	Suture of skin and subcutaneous tissue	467075	4.05
7	Other therapeutic procedures on muscles and tendons	327029	2.83
8	Debridement of wound; infection or burn	327245	2.83
9	Traction; splints; and other wound care	243695	2.11
10	Respiratory intubation and mechanical ventilation	240682	2.08

Table 21: Most Frequent Inpatient Procedures, All Trauma Inpatient Discharges. US Hospitals, 2000-2011.

Rank	Procedure	Frequency	Proportion
1	Treatment; fracture or dislocation of hip and femur	266158	9.41
2	Suture of skin and subcutaneous tissue	247305	8.74
3	Incision of pleura; thoracentesis; chest drainage	171518	6.06
4	Incision and excision of CNS	170116	6.01
5	Respiratory intubation and mechanical ventilation	167832	5.93
6	Other fracture and dislocation procedure	105088	3.71
7	Treatment; fracture or dislocation of lower extremity (other than hip or femur)	103392	3.65
8	Other OR therapeutic nervous system procedures	99278	3.51
9	Tracheostomy; temporary and permanent	99110	3.50
10	Debridement of wound; infection or burn	83918	2.97

Table 22: Most Frequent Inpatient Procedures, Severely Injured Trauma Inpatient Discharges. US Hospitals, 2000-2011.

AgeGroup	Description	Count	Proportion
Younger than 18	Other fracture and dislocation procedure	186681	13.44
	Treatment; fracture / dislocation lower extremity (other than hip or femur)	157861	11.36
	Treatment; fracture or dislocation of hip and femur	155407	11.19
	Treatment; fracture or dislocation of radius and ulna	127393	9.17
	Debridement of wound; infection or burn	67367	4.85
18 to 44	Treatment; fracture / dislocation lower extremity (other than hip or femur)	796223	19.57
	Treatment; fracture or dislocation of hip and femur	263852	6.49
	Other fracture and dislocation procedure	249641	6.14
	Suture of skin and subcutaneous tissue	241702	5.94
	Treatment; facial fracture or dislocation	178245	4.38
45 to 64	Treatment; fracture / dislocation lower extremity (other than hip or femur)	737841	23.32
	Treatment; fracture or dislocation of hip and femur	362365	11.45
	Other fracture and dislocation procedure	204342	6.46
	Treatment; fracture or dislocation of radius and ulna	153485	4.85
	Other therapeutic procedures on muscles and tendons	131402	4.15
65 to 84	Treatment; fracture or dislocation of hip and femur	1279755	28.92
	Hip replacement; total and partial	748324	16.91
	Treatment; fracture / dislocation lower extremity (other than hip or femur)	402930	9.11
	Other fracture and dislocation procedure	193838	4.38
	Treatment; fracture or dislocation of radius and ulna	150637	3.40
85 and Older	Treatment; fracture or dislocation of hip and femur	1003714	41.80
	Hip replacement; total and partial	543785	22.65
	Suture of skin and subcutaneous tissue	80940	3.37
	Blood transfusion	70278	2.93
	Treatment; fracture / dislocation lower extremity (other than hip or femur))	67180	2.80

Table 23: Most Frequent Procedures by Age Group, Count and Proportion of Age-Specific Total Inpatient Trauma Discharges, US Hospitals, 2000-2011.

	OR	2.5 %	97.5 %
(Intercept)	0.00	0.00	0.00
AGE	1.02	1.02	1.02
FEMALE	0.71	0.69	0.72
HOSP_TEACH	1.28	1.21	1.34
AWEEKEND	1.05	1.03	1.07
level.one	1.21	1.12	1.31
severe	10.76	10.31	11.23
Charlson	1.27	1.26	1.28

Table 24: Results of Logistic Regression Inpatient Mortality. Inpatient Trauma Discharges, US Hospitals, 2000-2011

Table 25:

	Dependent variable:
	DIED
AGE	0.023^{***}
	(0.0004)
FEMALE	-0.345^{***}
	(0.010)
HOSP_TEACH	0.243^{***}
	(0.025)
AWEEKEND	0.048^{***}
	(0.011)
level.one	0.192^{***}
	(0.040)
severe	2.376^{***}
	(0.022)
Charlson	0.238^{***}
	(0.004)
Constant	-6.174^{***}
	(0.030)
Observations	4,154,552
Log Likelihood	−393,196.000
Akaike Inf. Crit.	786,408.000
Note:	*p<0.1; **p<0.05; ***p<0.01

Age Group	Length of Stay 95% CI			
0 to 18 1	3.36 (3.25, 3.47) 18 to 44 2	4.75 (4.59, 4.91) 45 to 64 3	5.28 (5.14, 5.42)	
5.57 (5.51, 5.64) Over 84 5	5.52 (5.46, 5.57) height			

Table 26: Average Length of Stay by Age Group, All Injury and Trauma Hospital Discharges, US Hospitals, 2000-2011.

Year	Length of Stay 95% CI
2000	5.078 449 (4.92, 5.23)
2001	5.017093 (4.85, 5.18)
2002	5.093280 (4.93, 5.25)
2003	5.133066 (4.93, 5.32)
2004	5.169827 (4.96, 5.37)
2005	5.056644 (4.90, 5.20)
2006	5.189585 (5.03, 5.34)
2007	5.165124 (4.97, 5.35)
2008	5.125156 (4.93, 5.31)
2009	4.985826 (4.85, 5.11)
2010	5.179460 (4.99, 5.36)
2011	4.853177 (4.71, 4.99)

Table 27: Average Length by Year, All Injury and Trauma Hospital Discharges, US Hospitals, 2000-2011.

4 creating the injury file

StatTransfer to convert SAS file into a .csv file.[3] [4]

Use read.csv() to read in the approximately 2.1 GB NIS .csv file for the year 2000 took about 8 minutes. 7,450,992 observations with 116 variables. Saving this file as an R workspace (.Rdata) file took about 3 minutes. The file then takes about 2 minutes to load back in.

Using optimized version of read.csv with colClasses= and nrows= specified, but the .csv file has quoted integers which throws an error when colClasses are specified (and oddly doesn't when read.csv is simply left to its own devices...)

Using the fread() function from the data.table package much faster. 38 seconds compared to 8 minutes for read.csv

Create new csv's for each SAS file for each year and use fread on them to save them as read.table objects as well as data frames.

The base functions saveRDS() (with perhaps compress=F) and readRDS() faster way to save and load large files. [5] As per help file, "the ".rds" file extension is most often used." Differs from regular save() in that only saves a single object, usually a database. Regular load takes about 2 minutes to bring one of these big files into the workspace, readRDS takes about half that time.

After reading in files, check summary statistics for that year against numbers provided by AHRQ in pdf.

Note, warnings referring to E-codes and procedure codes that were coerced to character after initially be determined to be numeric, integer or logical by fread():

"Bumped column 29 to type character on data row 325570, field contains '"76525"'. Coercing previously read values in this column from logical, integer or numeric back to character which may not be lossless; e.g., if '00' and '000' occurred before they will now be just '0', and there may be inconsistencies with treatment of ',,' and ',NA,' too (if they occurred in this column before the bump). If this matters please rerun and set 'colClasses' to 'character' for this column. Please note that column type detection uses the first 5 rows, the middle 5 rows and the last 5 rows, so hopefully this message should be very rare. If reporting to datatable-help, please rerun and include the output from verbose=TRUE."

Also,

"Some columns have been read as type 'integer64' but package bit64 isn't loaded. Those columns will display as strange looking floating point data. There is no need to reload the data. Just require(bit64) to obtain the integer64 print method and print the data again."

[3] Good list of tips for working with large data sets here: https://theodi.org/blog/fig-data-11-tips-how-handle-big-data-r-and-1-bad-pun. A set of tutorials on working with the "data.table" package here: https://www.datacamp.com/courses/data-table-data-manipulation-r-tutorial

[4] Converting directly to an R workspace crashed.

[5] see http://stackoverflow.com/questions/11559628/speed-up-rdata-load

```r
nis.1998.core <- fread("~/HCUP Nationwide Inpatient Sample/1998/nis_1998_core.csv")
saveRDS(nis.1998.core, "~/HCUP Nationwide Inpatient Sample/1998/nis_1998_core.rds")
nis.1998.core <- readRDS("~/HCUP Nationwide Inpatient Sample/1998/nis_1998_core.rds")

nis.1999.core <- fread("~/HCUP Nationwide Inpatient Sample/1999/nis_1999_core.csv")
saveRDS(nis.1999.core, "~/HCUP Nationwide Inpatient Sample/1999/nis_1999_core.rds")
nis.1999.core <- readRDS("~/HCUP Nationwide Inpatient Sample/1999/nis_1999_core.rds")

nis.2000.core <- fread("~/HCUP Nationwide Inpatient Sample/2000/NIS_2000_ASCII/nis_2000_core.csv")
str(nis.2000.core)
saveRDS(nis.2000.core, file = "~/HCUP Nationwide Inpatient Sample/2000/NIS_2000_ASCII/nis_2000_core.
nis.2000.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2000/NIS_2000_ASCII/nis_2000_core.rds")

nis.2001.core <- fread("~/HCUP Nationwide Inpatient Sample/2001/NIS_2001_ASCII/nis_2001_core.csv")
saveRDS(nis.2001.core, file = "~/HCUP Nationwide Inpatient Sample/2001/NIS_2001_ASCII/nis.2001.core.
nis.2001.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2001/NIS_2001_ASCII/nis.2001.core.rds")
summary(nis.2001.core$AGE)  # spot on
summary(nis.2001.core$TOTCHG)  # spot on

nis.2002.core <- fread("~/HCUP Nationwide Inpatient Sample/2002/NIS_2002_ASCII/nis_2002_core.csv",
    sep = ",")
saveRDS(nis.2002.core, "~/HCUP Nationwide Inpatient Sample/2002/NIS_2002_ASCII/nis_2002_core.rds")
nis.2002.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2002/NIS_2002_ASCII/nis_2002_core.rds")
str(nis.2002.core)
summary(nis.2002.core$AGE)  # spot on
summary(nis.2002.core$TOTCHG)  # off by 5 on mean (but doc refers to 'cleaned version...')

nis.2003.core <- fread("~/HCUP Nationwide Inpatient Sample/2003/NIS_2003_ASCII/nis_2003_core_2.csv")
saveRDS(nis.2003.core, "~/HCUP Nationwide Inpatient Sample/2003/NIS_2003_ASCII/nis_2003_core.rds")
nis.2003.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2003/NIS_2003_ASCII/nis_2003_core.rds")

nis.2004.core <- fread("~/HCUP Nationwide Inpatient Sample/2004/NIS_2004_ASCII/nis_2004_core_2.csv")
saveRDS(nis.2004.core, "~/HCUP Nationwide Inpatient Sample/2004/NIS_2004_ASCII/nis_2004_core.rds")
nis.2004.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2004/NIS_2004_ASCII/nis_2004_core.rds")
summary(nis.2004.core$DXCCS1)  # spot on
summary(nis.2004.core$E_CCS1)  # spot on

nis.2005.core <- fread("~/HCUP Nationwide Inpatient Sample/2005/NIS_2005_CORE_ASC/nis_2005_core_2.cs
saveRDS(nis.2005.core, "~/HCUP Nationwide Inpatient Sample/2005/NIS_2005_CORE_ASC/nis_2005_core.rds"
nis.2005.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2005/NIS_2005_CORE_ASC/nis_2005_core.rd


nis.2006.core <- fread("~/HCUP Nationwide Inpatient Sample/2006/nis_2006_core_2.csv")
saveRDS(nis.2006.core, "~/HCUP Nationwide Inpatient Sample/2006/nis_2006_core_2.rds")
nis.2006.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2006/nis_2006_core_2.rds")
```

```
nis.2007.core <- fread("~/HCUP Nationwide Inpatient Sample/2007/nis_2007_core_2.csv")
saveRDS(nis.2007.core, "~/HCUP Nationwide Inpatient Sample/2007/nis_2007_core_2.rds")
nis.2007.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2007/nis_2007_core_2.rds")


nis.2008.core <- fread("~/HCUP Nationwide Inpatient Sample/2008/nis_2008_core_2.csv")
saveRDS(nis.2008.core, "~/HCUP Nationwide Inpatient Sample/2008/nis_2008_core_2.rds")
nis.2008.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2008/nis_2008_core_2.rds")

nis.2009.core <- fread("~/HCUP Nationwide Inpatient Sample/2009/nis_2009_core_2.csv")
saveRDS(nis.2009.core, "~/HCUP Nationwide Inpatient Sample/2009/nis_2009_core_2.rds")
nis.2009.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2009/nis_2009_core_2.rds")

nis.2010.core <- fread("~/HCUP Nationwide Inpatient Sample/2010/nis_2010_core_2.csv")
saveRDS(nis.2010.core, "~/HCUP Nationwide Inpatient Sample/2010/nis_2010_core_2.rds")
nis.2010.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2010/nis_2010_core_2.rds")

nis.2011.core <- fread("~/HCUP Nationwide Inpatient Sample/2011/nis_2011_core_2.csv")
saveRDS(nis.2011.core, "~/HCUP Nationwide Inpatient Sample/2011/nis_2011_core_2.rds")
nis.2011.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2011/nis_2011_core_2.rds")


nis.2012.core <- fread("~/HCUP Nationwide Inpatient Sample/2012/nis_2012_core_2.csv")
saveRDS(nis.2012.core, "~/HCUP Nationwide Inpatient Sample/2012/nis_2012_core_2.rds")
nis.2012.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2012/nis_2012_core_2.rds")
```

4.1 selecting out injuries

Four possible variables available to identify injury patients.

- ICD9 diagnosis code between 800 and 999
- the presence of an E code
- CCS code related to injury or trauma (see injuryCCS.txt)
- the presence of an E_CCS1 variable

For each of these variables, there are multiple entries, with the first entry the "principal" diagnosis. According to HCUP [6] file:///Users/dimagc01/Box%20Sync/hcup/hcupPrimaryDx.pdf "The ICD-9-CM coding guidelines define principal diagnosis as "that condition established after study to be chiefly responsible for occasioning the admission of the patient to the hospital for care."" For outpatient and ED services, " UB-04 coding manual ... guides hospitals to use the "first-listed diagnosis" in lieu of "principal diagnosis" "

Examined all four possible injury identification variables for the 2004 data.

[6] HCUP Methods Series: Special Study on the Meaning of the First Listed Diagnosis

All ICD9 codes between 800 and 990:

```
nis.2004.core$DX1 %in% 800:999 | nis.2004.core$DX1 %in% 8000:9990 | nis.2004.core$DX1 %in% 80
```

Returned 587,110 observations. Rough estimate is 5 times that number, or about 2.9 million. HCUP statistical brief [7] cites about 1.9 million for 2004. National Trauma Institute cites 2.3 million trauma-related hospital admissions in 2014 [8] still considerably higher than my results.

The HCUP study used the following ICD codes to define injury:

800-909.2, 909.4, 909.9, 910-994.9, 995.5-995.59, and 995.80-995.85.

Restricting to code between 800 and 960 returned 397,987 observations or roughly 1.98 million admissions. Much closer to the HCUP number.

The CCS codes for injury related diagnoses returned too few results (86,273 observations or about half a million admissions). Ecodes returned too many results. This was because Ecodes were present for discharges where the injury was the second, third or higher diagnosis. Will restrict to primary or principal diagnoses as was done in the HCUP statistical brief.

```
nis.2004.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2004/NIS_2004_ASCII/nis_2004_core.rds")

class(nis.2004.core$DX1)
table(nis.2004.core$DX1[nis.2004.core$DX1 %in% 800:999 | nis.2004.core$DX1 %in%
    8000:9990 | nis.2004.core$DX1 %in% 80000:99900])
length(nis.2004.core$DX1[nis.2004.core$DX1 %in% 800:999 | nis.2004.core$DX1 %in%
    8000:9990 | nis.2004.core$DX1 %in% 80000:99900])  # 587110

length(nis.2004.core$DX1[nis.2004.core$DX1 %in% 800:996 | nis.2004.core$DX1 %in%
    8000:9960 | nis.2004.core$DX1 %in% 80000:99600])  # 397987

sum(nis.2004.core$DXCCS1 %in% c(227, 233, 234, 239, 662, 225))  # 86273 based on CCS codes

sum(nis.2004.core$ECODE1 != "")  # 943640 based on presence of an Ecode

sum(!is.na(nis.2004.core$E_CCS1))  # 930219 based on presence of CCS-derived Ecode
```

Following code creates a file of injury inpatient discharges for each year from 1998 to 2012. There is a gradual rise in the number of admissions over that time (though that may simply reflect increasing population). Of note, even at this early stage, increasing median age of injured patients admitted to hospital, which was 50 in 1998, and 58 in 2012.

```
nis.1998.core <- readRDS("~/HCUP Nationwide Inpatient Sample/1998/nis_1998_core.rds")
nis.1998.inj <- nis.1998.core[nis.1998.core$DX1 %in% 800:996 |
    nis.1998.core$DX1 %in% 8000:9960 | nis.1998.core$DX1 %in%
    80000:99600, ]
```

[7] HCUP Statistical Brief 18: Frequency and Costs of Hospital Admissions for Injury, 2004 (http://www.hcup-us.ahrq.gov/reports/statbriefs/sb18.pdf)

[8] (http://www.nationaltraumainstitute.org/home/trauma_statistics.html)

```r
saveRDS(nis.1998.inj, "~/HCUPinjury/nis_1998_inj.rds")
nrow(nis.1998.inj)  # 349270
summary(nis.1998.inj$AGE)  # median 50
rm(nis.1998.core, nis.1998.inj)

nis.1999.core <- readRDS("~/HCUP Nationwide Inpatient Sample/1999/nis_1999_core.rds")
nis.1999.inj <- nis.1999.core[nis.1999.core$DX1 %in% 800:996 |
    nis.1999.core$DX1 %in% 8000:9960 | nis.1999.core$DX1 %in%
    80000:99600, ]
saveRDS(nis.1999.inj, "~/HCUPinjury/nis_1999_inj.rds")
nrow(nis.1999.inj)  # 350136
summary(nis.1999.inj$AGE)  # median 50
rm(nis.1999.core, nis.1999.inj)

nis.2000.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2000/NIS_2000_ASCII/nis_2000_core.rds")
nis.2000.inj <- nis.2000.core[nis.2000.core$DX1 %in% 800:996 |
    nis.2000.core$DX1 %in% 8000:9960 | nis.2000.core$DX1 %in%
    80000:99600, ]
saveRDS(nis.2000.inj, "~/HCUPinjury/nis_2000_inj.rds")
nrow(nis.2000.inj)  # 350031
summary(nis.2000.inj$AGE)  # median 51
rm(nis.2000.core, nis.2000.inj)

nis.2001.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2001/NIS_2001_ASCII/nis.2001.core.rds")
nis.2001.inj <- nis.2001.core[nis.2001.core$DX1 %in% 800:996 |
    nis.2001.core$DX1 %in% 8000:9960 | nis.2001.core$DX1 %in%
    80000:99600, ]
saveRDS(nis.2001.inj, "~/HCUPinjury/nis_2001_inj.rds")
nrow(nis.2001.inj)  # 344147
summary(nis.2001.inj$AGE)  # median 53
rm(nis.2001.core, nis.2001.inj)

nis.2002.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2002/NIS_2002_ASCII/nis_2002_core.rds")
nis.2002.inj <- nis.2002.core[nis.2002.core$DX1 %in% 800:996 |
    nis.2002.core$DX1 %in% 8000:9960 | nis.2002.core$DX1 %in%
    80000:99600, ]
saveRDS(nis.2002.inj, "~/HCUPinjury/nis_2002_inj.rds")
nrow(nis.2002.inj)  # 366900
summary(nis.2002.inj$AGE)  # median 52
rm(nis.2002.core, nis.2002.inj)

nis.2003.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2003/NIS_2003_ASCII/nis_2003_core.rds")
nis.2003.inj <- nis.2003.core[nis.2003.core$DX1 %in% 800:996 |
    nis.2003.core$DX1 %in% 8000:9960 | nis.2003.core$DX1 %in%
    80000:99600, ]
saveRDS(nis.2003.inj, "~/HCUPinjury/nis_2003_inj.rds")
nrow(nis.2003.inj)  # 381525
```

```
summary(nis.2003.inj$AGE)  # 52
rm(nis.2003.core, nis.2003.inj)

nis.2004.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2004/NIS_2004_ASCII/nis_2004_core.rds")
nis.2004.inj <- nis.2004.core[nis.2004.core$DX1 %in% 800:996 |
    nis.2004.core$DX1 %in% 8000:9960 | nis.2004.core$DX1 %in%
    80000:99600, ]
saveRDS(nis.2004.inj, "~/HCUPinjury/nis_2004_inj.rds")
nrow(nis.2004.inj)  # 397987
summary(nis.2004.inj$AGE)  # 51
rm(nis.2004.core, nis.2004.inj)


nis.2005.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2005/NIS_2005_CORE_ASC/nis_2005_core.rd
nis.2005.inj <- nis.2005.core[nis.2005.core$DX1 %in% 800:996 |
    nis.2005.core$DX1 %in% 8000:9960 | nis.2005.core$DX1 %in%
    80000:99600, ]
saveRDS(nis.2005.inj, "~/HCUPinjury/nis_2005_inj.rds")
nrow(nis.2005.inj)  # 379962
summary(nis.2005.inj$AGE)  # 53
rm(nis.2005.core, nis.2005.inj)


nis.2006.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2006/nis_2006_core_2.rds")
nis.2006.inj <- nis.2006.core[nis.2006.core$DX1 %in% 800:996 |
    nis.2006.core$DX1 %in% 8000:9960 | nis.2006.core$DX1 %in%
    80000:99600, ]
saveRDS(nis.2006.inj, "~/HCUPinjury/nis_2006_inj.rds")
nrow(nis.2006.inj)  # 388300
summary(nis.2006.inj$AGE)  # 53
rm(nis.2006.core, nis.2006.inj)


nis.2007.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2007/nis_2007_core_2.rds")
nis.2007.inj <- nis.2007.core[nis.2007.core$DX1 %in% 800:996 |
    nis.2007.core$DX1 %in% 8000:9960 | nis.2007.core$DX1 %in%
    80000:99600, ]
saveRDS(nis.2007.inj, "~/HCUPinjury/nis_2007_inj.rds")
nrow(nis.2007.inj)  # 384292
summary(nis.2007.inj$AGE)  # 55
rm(nis.2007.core, nis.2007.inj)


nis.2008.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2008/nis_2008_core_2.rds")
nis.2008.inj <- nis.2008.core[nis.2008.core$DX1 %in% 800:996 |
    nis.2008.core$DX1 %in% 8000:9960 | nis.2008.core$DX1 %in%
    80000:99600, ]
```

```
saveRDS(nis.2008.inj, "~/HCUPinjury/nis_2008_inj.rds")
nrow(nis.2008.inj)  # 390239
summary(nis.2008.inj$AGE)  # 57
rm(nis.2008.core, nis.2008.inj)


nis.2009.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2009/nis_2009_core_2.rds")
nis.2009.inj <- nis.2009.core[nis.2009.core$DX1 %in% 800:996 |
    nis.2009.core$DX1 %in% 8000:9960 | nis.2009.core$DX1 %in%
    80000:99600, ]
saveRDS(nis.2009.inj, "~/HCUPinjury/nis_2009_inj.rds")
nrow(nis.2009.inj)  # 375643
summary(nis.2009.inj$AGE)  # 57
rm(nis.2009.core, nis.2009.inj)


nis.2010.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2010/nis_2010_core_2.rds")
nis.2010.inj <- nis.2010.core[nis.2010.core$DX1 %in% 800:996 |
    nis.2010.core$DX1 %in% 8000:9960 | nis.2010.core$DX1 %in%
    80000:99600, ]
saveRDS(nis.2010.inj, "~/HCUPinjury/nis_2010_inj.rds")
nrow(nis.2010.inj)  # 413786
summary(nis.2010.inj$AGE)  #
rm(nis.2010.core, nis.2010.inj)


nis.2011.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2011/nis_2011_core_2.rds")
nis.2011.inj <- nis.2011.core[nis.2011.core$DX1 %in% 800:996 |
    nis.2011.core$DX1 %in% 8000:9960 | nis.2011.core$DX1 %in%
    80000:99600, ]
saveRDS(nis.2011.inj, "~/HCUPinjury/nis_2011_inj.rds")
nrow(nis.2011.inj)  # 392184
summary(nis.2011.inj$AGE)  #59
rm(nis.2011.core, nis.2011.inj)

nis.2012.core <- readRDS("~/HCUP Nationwide Inpatient Sample/2012/nis_2012_core_2.rds")
nis.2012.inj <- nis.2012.core[nis.2012.core$DX1 %in% 800:996 |
    nis.2012.core$DX1 %in% 8000:9960 | nis.2012.core$DX1 %in%
    80000:99600, ]
saveRDS(nis.2012.inj, "~/HCUPinjury/nis_2012_inj.rds")
nrow(nis.2012.inj)  # 365021
summary(nis.2012.inj$AGE)  # 58
rm(nis.2012.core, nis.2012.inj)
```

Bind the individual year files into a single file. Using data.table::rbindlist() with option to match columns by name (rather than position, which is default) and fill in non-matching columns with NAs (same behavior as plyr:rbind.fill)

N.B. Weights post 1998 should be fine. May be an issue with some variable names pre 2003. Appears that some of the pre-2003 files have updated variable names as per supplemental files for trends etc....

Full file of 5,629,423 observations and 175 variables saved.

```
ls()

nis.1998.inj <- readRDS("~/HCUPinjury/nis_1998_inj.rds")
nis.1999.inj <- readRDS("~/HCUPinjury/nis_1999_inj.rds")
nis.2000.inj <- readRDS("~/HCUPinjury/nis_2000_inj.rds")
nis.2001.inj <- readRDS("~/HCUPinjury/nis_2001_inj.rds")
nis.2002.inj <- readRDS("~/HCUPinjury/nis_2002_inj.rds")
nis.2003.inj <- readRDS("~/HCUPinjury/nis_2003_inj.rds")
nis.2004.inj <- readRDS("~/HCUPinjury/nis_2004_inj.rds")
nis.2005.inj <- readRDS("~/HCUPinjury/nis_2005_inj.rds")
nis.2006.inj <- readRDS("~/HCUPinjury/nis_2006_inj.rds")
nis.2007.inj <- readRDS("~/HCUPinjury/nis_2007_inj.rds")
nis.2008.inj <- readRDS("~/HCUPinjury/nis_2008_inj.rds")
nis.2009.inj <- readRDS("~/HCUPinjury/nis_2009_inj.rds")
nis.2010.inj <- readRDS("~/HCUPinjury/nis_2010_inj.rds")
nis.2011.inj <- readRDS("~/HCUPinjury/nis_2011_inj.rds")
nis.2012.inj <- readRDS("~/HCUPinjury/nis_2012_inj.rds")

nis.98_12.inj <- rbindlist(list(nis.1998.inj, nis.1999.inj, nis.2000.inj,
    nis.2001.inj, nis.2002.inj, nis.2003.inj, nis.2004.inj, nis.2005.inj,
    nis.2006.inj, nis.2007.inj, nis.2008.inj, nis.2009.inj, nis.2010.inj,
    nis.2011.inj, nis.2012.inj), use.names = TRUE, fill = TRUE)

str(nis.98_12.inj)  # 5629423 obs. of  175 variables

saveRDS(nis.98_12.inj, "~/HCUPinjury/nis.98_12.inj.rds")
```

Use the R "icd9" package to apply descriptors to the diagnostic codes, and clean up codes to restrict to trauma.

```
inj <- readRDS("~/nis.00_11.inj.rds")

icd.tab1 <- as.data.frame(table(inj$DX1))

nrow(icd.tab1)  #2374

icd9Explain(icd.tab1$Var1, brief = T)

# use icd9::icd9Explain() to add dx descriptions (note: loop
# because apply would not accept icd9Explain as a fx...)
for (i in 1:nrow(icd.tab1)) {
    icd.tab1$descriptor[i] <- icd9Explain(icd.tab1$Var1[i], brief = T)
}
```

```
head(icd.tab1)

icd.tab1
```

Restricting to acute injuries, so removed the following "late effect" primary diagnoses (ICD 9050-9099). Removed insect bites, poisonings, anaphylaxis and some additional miscellaneous diagnoses (malignant hyperthermia, systemic inflammatory response syndrome, malfunctioning cardiac devices). Add age groups.

```
lateEffects <- as.character(c(9050:9099))
insectBites <- as.character(c(9104, 9105, 9114, 9115, 9124, 9125,
    9134, 9135, 9144, 9145, 9154, 9155, 9164, 9165, 9174, 9175,
    9194, 9195))
poisoning <- as.character(c(9600:9649, 96500:96502, 96509, 9651,
    9654, 9655, 96561, 96569, 9657:9690, 96900:96909, 96970:96973,
    9691:9697, 9670:9679, 96979, 9698:9809, 97081, 97089, 981,
    9820:9859, 986, 9870:9897, 98981:98989, 9899, 990, 9910:9952,
    99520:99529, 9953, 9954))
anaphylaxis <- as.character(c(99560:99569, 9957))
misc <- as.character(c(99586:99600))

non.trauma <- c(lateEffects, insectBites, poisoning, anaphylaxis,
    misc)

inj2 <- inj[!inj$DX1 %in% non.trauma, ]

icd.tab2 <- as.data.frame(table(inj2$DX1))

nrow(icd.tab2)  #2006

for (i in 1:nrow(icd.tab2)) {
    icd.tab2$descriptor[i] <- icd9Explain(icd.tab2$Var1[i], brief = T)
}

saveRDS(inj2, "~/nis.00_11.inj.rds")

# create age groups
inj$ageGrp[inj$AGE < 18] <- "1.LT18"
inj$ageGrp[inj$AGE >= 18 & inj$AGE < 45] <- "2.GT17.LT45"
inj$ageGrp[inj$AGE >= 45 & inj$AGE < 65] <- "3.GT44.LT65"
inj$ageGrp[inj$AGE >= 65 & inj$AGE < 85] <- "4.GT64.LT85"
inj$ageGrp[inj$AGE > 84] <- "5.GT84"


# survey doesn't seem to like non-numeric grouping variablews
# sometimes
inj$ageGrp.num[inj$ageGrp == "1.LT18"] <- 1
```

```
inj$ageGrp.num[inj$ageGrp == "2.GT17.LT45"] <- 2
inj$ageGrp.num[inj$ageGrp == "3.GT44.LT65"] <- 3
inj$ageGrp.num[inj$ageGrp == "4.GT64.LT85"] <- 4
inj$ageGrp.num[inj$ageGrp == "5.GT84"] <- 5
```

4.2 Barell Matrix Diagnostic Codes

Map ICD9 diagnostic codes to the Barell Matrix.

```
inj.sub <- inj

# code Barrel matrix (see rBarrel.txt and sasBarrel.txt)

# create 3 input variables (NB: change from CDC SAS Code,
# using DX1.3, 1.4, 1.4 because DX13, 14,15 already exist in
# the data)
inj.sub$DX1.3 <- substr(inj.sub$DX1, 1, 3)  # [3 digit code for first-listed ICD-9 CM diagnosis]
inj.sub$DX1.4 <- ifelse(nchar(inj.sub$DX1) == 4, inj.sub$DX1,
    NA)  # [4 digit code for first-listed diagnosis]
inj.sub$DX1.5 <- ifelse(nchar(inj.sub$DX1) == 5, inj.sub$DX1,
    NA)  # [5 digit code for first-listed diagnosis]
inj.sub$D5 <- ifelse(nchar(inj.sub$DX1) == 5, substr(inj.sub$DX1,
    5, 5), NA)  # [5th digit of code]

# functions to return values in a range (replicate the SAS
# code)
"%betw1%" <- function(x, ends) ends[1] <= x & x <= ends[2]
"%betw2%" <- function(x, ends) x >= ends[1] & x <= ends[2]  # for the GE LE syntax

# Barrel Code

# ISRCODE
inj.sub$ISRCODE[inj.sub$DX1.3 %betw1% c("800", "829")] <- 1
inj.sub$ISRCODE[inj.sub$DX1.3 %betw2% c("830", "839")] <- 2
inj.sub$ISRCODE[inj.sub$DX1.3 %betw2% c("840", "848")] <- 3
inj.sub$ISRCODE[inj.sub$DX1.3 %betw1% c("860", "869") | inj.sub$DX1.3 %betw1%
    c("850", "854") | inj.sub$DX1.3 == "952" | inj.sub$DX1.5 ==
    "99555"] <- 4
inj.sub$ISRCODE[inj.sub$DX1.3 %betw1% c("870", "884") | inj.sub$DX1.3 %betw1%
    c("890", "894")] <- 5
inj.sub$ISRCODE[inj.sub$DX1.3 %betw1% c("885", "887") | inj.sub$DX1.3 %betw1%
    c("895", "897")] <- 6
inj.sub$ISRCODE[inj.sub$DX1.3 %betw2% c("900", "904")] <- 7
inj.sub$ISRCODE[inj.sub$DX1.3 %betw2% c("910", "924")] <- 8
inj.sub$ISRCODE[inj.sub$DX1.3 %betw2% c("925", "929")] <- 9
inj.sub$ISRCODE[inj.sub$DX1.3 %betw2% c("940", "949")] <- 10
```

```
inj.sub$ISRCODE[inj.sub$DX1.3 %betw2% c("950", "951") | inj.sub$DX1.3 %betw1%
    c("953", "957")] <- 11
inj.sub$ISRCODE[inj.sub$DX1.3 == "959"] <- 12
inj.sub$ISRCODE[inj.sub$DX1.3 %betw1% c("930", "939") | inj.sub$DX1.3 %betw1%
    c("960", "994") | inj.sub$DX1.3 %betw1% c("905", "908") |
    inj.sub$DX1.4 %betw1% c("9090", "9092") | inj.sub$DX1.3 ==
    "958" | inj.sub$DX1.5 %betw1% c("99550", "99554") | inj.sub$DX1.5 ==
    "99559" | inj.sub$DX14 == "9094" | inj.sub$DX1.4 == "9099" |
    inj.sub$DX1.5 %betw1% c("99580", "99585")] <- 13

table(inj.sub$ISRCODE)


# ISRSITE
inj.sub$ISRSITE[inj.sub$DX1.4 %betw1% c("8001", "8004") | inj.sub$DX1.4 %betw1%
    c("8006", "8009") | inj.sub$DX1.5 %betw1% c("80003", "80005") |
    inj.sub$DX1.5 %betw1% c("80053", "80055") | inj.sub$DX1.4 %betw1%
    c("8011", "8014") | inj.sub$DX1.4 %betw1% c("8016", "8019") |
    inj.sub$DX1.5 %betw1% c("80103", "80105") | inj.sub$DX1.5 %betw1%
    c("80153", "80155") | inj.sub$DX1.4 %betw1% c("8031", "8034") |
    inj.sub$DX1.4 %betw1% c("8036", "8039") | inj.sub$DX1.5 %betw1%
    c("80303", "80305") | inj.sub$DX1.5 %betw1% c("80353", "80355") |
    inj.sub$DX1.4 %betw1% c("8041", "8044") | inj.sub$DX1.4 %betw1%
    c("8046", "8049") | inj.sub$DX1.5 %betw1% c("80403", "80405") |
    inj.sub$DX1.5 %betw1% c("80453", "80455") | inj.sub$DX1.4 %betw1%
    c("8502", "8504") | inj.sub$DX1.3 %betw1% c("851", "854") |
    inj.sub$DX1.4 %betw1% c("9501", "9503") | inj.sub$DX1.5 ==
    "99555"] <- 1

inj.sub$ISRSITE[inj.sub$DX1.5 == "80000" | inj.sub$DX1.5 == "80002" |
    inj.sub$DX1.5 == "80006" | inj.sub$DX1.5 == "80009" | inj.sub$DX1.5 ==
    "80100" | inj.sub$DX1.5 == "80102" | inj.sub$DX1.5 == "80106" |
    inj.sub$DX1.5 == "80109" | inj.sub$DX1.5 == "80300" | inj.sub$DX1.5 ==
    "80302" | inj.sub$DX1.5 == "80306" | inj.sub$DX1.5 == "80309" |
    inj.sub$DX1.5 == "80400" | inj.sub$DX1.5 == "80402" | inj.sub$DX1.5 ==
    "80406" | inj.sub$DX1.5 == "80409" | inj.sub$DX1.5 == "80050" |
    inj.sub$DX1.5 == "80052" | inj.sub$DX1.5 == "80056" | inj.sub$DX1.5 ==
    "80059" | inj.sub$DX1.5 == "80150" | inj.sub$DX1.5 == "80152" |
    inj.sub$DX1.5 == "80156" | inj.sub$DX1.5 == "80159" | inj.sub$DX1.5 ==
    "80350" | inj.sub$DX1.5 == "80352" | inj.sub$DX1.5 == "80356" |
    inj.sub$DX1.5 == "80359" | inj.sub$DX1.5 == "80450" | inj.sub$DX1.5 ==
    "80452" | inj.sub$DX1.5 == "80456" | inj.sub$DX1.5 == "80459" |
    inj.sub$DX1.4 == "8500" | inj.sub$DX1.4 == "8501" | inj.sub$DX1.4 ==
    "8505" | inj.sub$DX1.4 == "8509"] <- 2

inj.sub$ISRSITE[inj.sub$DX1.5 == "80001" | inj.sub$DX1.5 == "80051" |
    inj.sub$DX1.5 == "80101" | inj.sub$DX1.5 == "80151" | inj.sub$DX1.5 ==
```

```
    "80301" | inj.sub$DX1.5 == "80351" | inj.sub$DX1.5 == "80401" |
    inj.sub$DX1.5 == "80451"] <- 3

inj.sub$ISRSITE[inj.sub$DX1.3 == "951" | inj.sub$DX1.4 == "8730" |
    inj.sub$DX1.4 == "8731" | inj.sub$DX1.4 == "8738" | inj.sub$DX1.4 ==
    "8739" | (inj.sub$DX1.3 == "941" & inj.sub$DX5 == "6") |
    inj.sub$DX1.5 == "95901"] <- 4

inj.sub$ISRSITE[inj.sub$DX1.3 == "802" | inj.sub$DX1.3 == "830" |
    inj.sub$DX1.4 == "8480" | inj.sub$DX1.4 == "8481" | inj.sub$DX1.3 ==
    "872" | inj.sub$DX1.4 %betw1% c("8732", "8737") | (inj.sub$DX1.3 ==
    "941" & inj.sub$DX5 == "1") | (inj.sub$DX1.3 == "941" & inj.sub$DX5 %betw1%
    c("3", "5")) | (inj.sub$DX1.3 == "941" & inj.sub$DX5 == "7")] <- 5

inj.sub$ISRSITE[inj.sub$DX1.4 == "9500" | inj.sub$DX1.4 == "9509" |
    inj.sub$DX1.3 %betw1% c("870", "871") | inj.sub$DX1.3 ==
    "921" | inj.sub$DX1.3 == "918" | inj.sub$DX1.3 == "940" |
    (inj.sub$DX1.3 == "941" & inj.sub$DX5 == "2")] <- 6

inj.sub$ISRSITE[inj.sub$DX1.4 %betw1% c("8075", "8076") | inj.sub$DX1.4 ==
    "8482" | inj.sub$DX1.4 == "9252" | inj.sub$DX1.4 == "9530" |
    inj.sub$DX1.4 == "9540" | inj.sub$DX1.3 == "874" | (inj.sub$DX1.3 ==
    "941" & inj.sub$DX5 == "8")] <- 7

inj.sub$ISRSITE[inj.sub$DX1.4 == "9251" | inj.sub$DX1.3 == "900" |
    inj.sub$DX1.4 == "9570" | inj.sub$DX1.3 == "910" | inj.sub$DX1.3 ==
    "920" | inj.sub$DX1.4 == "9470" | inj.sub$DX1.5 == "95909" |
    (inj.sub$DX1.3 == "941" & inj.sub$DX5 == "0") | inj.sub$DX5 ==
    "9"] <- 8

inj.sub$ISRSITE[inj.sub$DX1.4 %betw1% c("8060", "8061") | inj.sub$DX1.4 ==
    "9520"] <- 9

inj.sub$ISRSITE[inj.sub$DX1.4 %betw1% c("8062", "8063") | inj.sub$DX1.4 ==
    "9521"] <- 10

inj.sub$ISRSITE[inj.sub$DX1.4 %betw1% c("8064", "8065") | inj.sub$DX1.4 ==
    "9522"] <- 11

inj.sub$ISRSITE[inj.sub$DX1.4 %betw1% c("8066", "8067") | inj.sub$DX1.4 %betw1%
    c("9523", "9524")] <- 12

inj.sub$ISRSITE[inj.sub$DX1.4 %betw1% c("8068", "8069") | inj.sub$DX1.4 %betw1%
    c("9528", "9529")] <- 13

inj.sub$ISRSITE[inj.sub$DX1.4 %betw1% c("8050", "8051") | inj.sub$DX1.4 %betw1%
    c("8390", "8391") | inj.sub$DX1.4 == "8470"] <- 14
```

```
inj.sub$ISRSITE[inj.sub$DX1.4 %betw1% c("8052", "8053") | "83921" ==
    inj.sub$DX1.5 | "83931" == inj.sub$DX1.5 | inj.sub$DX1.4 ==
    "8471"] <- 15

inj.sub$ISRSITE[inj.sub$DX1.4 %betw1% c("8054", "8055") | "83920" ==
    inj.sub$DX1.5 | "83930" == inj.sub$DX1.5 | inj.sub$DX1.4 ==
    "8472"] <- 16

inj.sub$ISRSITE[inj.sub$DX1.4 %betw1% c("8056", "8057") | "83941" ==
    inj.sub$DX1.5 | "83942" == inj.sub$DX1.5 | inj.sub$DX1.5 %betw1%
    c("83951", "83952") | inj.sub$DX1.4 %betw1% c("8473,8474")] <- 17

inj.sub$ISRSITE[inj.sub$DX1.4 %betw1% c("8058", "8059") | "83940" ==
    inj.sub$DX1.5 | "83949" == inj.sub$DX1.5 | "83950" == inj.sub$DX1.5 |
    inj.sub$DX1.5 == "83959"] <- 18

inj.sub$ISRSITE[inj.sub$DX1.4 %betw1% c("8070", "8074") | inj.sub$DX1.5 ==
    "83961" | inj.sub$DX1.5 == "83971" | inj.sub$DX1.4 %betw1%
    c("8483", "8484") | inj.sub$DX1.5 == "92619" | inj.sub$DX1.3 %betw1%
    c("860", "862") | inj.sub$DX1.3 == "901" | inj.sub$DX1.4 ==
    "9531" | inj.sub$DX1.3 == "875" | inj.sub$DX1.4 == "8790" |
    inj.sub$DX1.4 == "8791" | inj.sub$DX1.4 == "9220" | inj.sub$DX1.4 ==
    "9221" | inj.sub$DX1.5 == "92233" | (inj.sub$DX1.3 == "942" &
    inj.sub$DX5 == "1") | inj.sub$DX5 == "2"] <- 19

inj.sub$ISRSITE[inj.sub$DX1.3 %betw1% c("863", "866") | inj.sub$DX1.3 ==
    "868" | inj.sub$DX1.4 %betw1% c("9020", "9024") | inj.sub$DX1.4 ==
    "9532" | inj.sub$DX1.4 == "9535" | inj.sub$DX1.4 %betw1%
    c("8792", "8795") | inj.sub$DX1.4 == "9222" | (inj.sub$DX1.3 ==
    "942" & inj.sub$DX5 == "3") | inj.sub$DX1.4 == "9473"] <- 20

inj.sub$ISRSITE[inj.sub$DX1.3 == "808" | inj.sub$DX1.5 == "83969" |
    inj.sub$DX1.5 == "83979" | inj.sub$DX1.3 == "846" | inj.sub$DX1.4 ==
    "8485" | inj.sub$DX1.4 == "9260" | inj.sub$DX1.5 == "92612" |
    inj.sub$DX1.3 == "867" | inj.sub$DX1.4 == "9025" | inj.sub$DX1.5 %betw1%
    c("90281", "90282") | inj.sub$DX1.4 == "9533" | inj.sub$DX1.3 %betw1%
    c("877", "878") | inj.sub$DX1.4 == "9224" | (inj.sub$DX1.3 ==
    "942" & inj.sub$DX5 == "5") | inj.sub$DX1.4 == "9474"] <- 21

inj.sub$ISRSITE[inj.sub$DX1.3 == "809" | inj.sub$DX1.4 %betw1%
    c("9268", "9269") | inj.sub$DX1.4 == "9541" | inj.sub$DX1.4 %betw1%
    c("9548,9549") | inj.sub$DX1.4 %betw1% c("8796", "8797") |
    inj.sub$DX1.4 %betw1% c("9228,9229") | inj.sub$DX1.3 == "911" |
    (inj.sub$DX1.3 == "942" & inj.sub$DX5 == "9") | inj.sub$DX1.4 ==
    "9591"] <- 22
```

```
inj.sub$ISRSITE[inj.sub$DX1.4 == "8479" | inj.sub$DX1.5 == "92611" |
    inj.sub$DX1.3 == "876" | inj.sub$DX1.5 == "92232" | inj.sub$DX1.5 ==
    "92231" | (inj.sub$DX1.3 == "942" & inj.sub$DX5 == "4")] <- 23

inj.sub$ISRSITE[inj.sub$DX1.3 %betw1% c("810", "812") | inj.sub$DX1.3 ==
    "831" | inj.sub$DX1.3 == "840" | inj.sub$DX1.3 == "880" |
    inj.sub$DX1.4 %betw1% c("8872", "8873") | (inj.sub$DX1.3 ==
    "943" & inj.sub$DX5 %betw1% c("3", "6")) | inj.sub$DX1.3 ==
    "912" | inj.sub$DX1.4 == "9230" | inj.sub$DX1.4 == "9270" |
    inj.sub$DX1.4 == "9592"] <- 24

inj.sub$ISRSITE[inj.sub$DX1.3 == "813" | inj.sub$DX1.3 == "832" |
    inj.sub$DX1.3 == "841" | (inj.sub$DX1.3 == "881" & inj.sub$DX5 %betw1%
    c("0", "1")) | inj.sub$DX1.4 %betw1% c("8870", "8871") |
    inj.sub$DX1.4 == "9231" | inj.sub$DX1.4 == "9271" | (inj.sub$DX1.3 ==
    "943" & inj.sub$DX5 %betw1% c("1", "2"))] <- 25

inj.sub$ISRSITE[inj.sub$DX1.3 %betw1% c("814", "817") | inj.sub$DX1.3 %betw1%
    c("833", "834") | inj.sub$DX1.3 == "842" | (inj.sub$DX1.3 ==
    "881" & inj.sub$DX5 == "2") | inj.sub$DX1.3 %betw1% c("882",
    "883") | inj.sub$DX1.3 %betw1% c("885", "886") | inj.sub$DX1.3 %betw1%
    c("914", "915") | inj.sub$DX1.4 %betw1% c("9232", "9233") |
    inj.sub$DX1.4 %betw1% c("9272", "9273") | inj.sub$DX1.3 ==
    "944" | inj.sub$DX1.4 %betw1% c("9594", "9595")] <- 26

inj.sub$ISRSITE[inj.sub$DX1.3 == "818" | inj.sub$DX1.3 == "884" |
    inj.sub$DX1.4 %betw1% c("8874", "8877") | inj.sub$DX1.3 ==
    "903" | inj.sub$DX1.3 == "913" | inj.sub$DX1.4 == "9593" |
    inj.sub$DX1.4 %betw1% c("9238", "9239") | inj.sub$DX1.4 %betw1%
    c("9278", "9279") | inj.sub$DX1.4 == "9534" | inj.sub$DX1.3 ==
    "955" | (inj.sub$DX1.3 == "943" & inj.sub$DX5 == "0") | inj.sub$DX5 ==
    "9"] <- 27

inj.sub$ISRSITE[inj.sub$DX1.3 == "820" | inj.sub$DX1.3 == "835" |
    inj.sub$DX1.3 == "843" | inj.sub$DX1.5 == "92401" | inj.sub$DX1.5 ==
    "92801"] <- 28

inj.sub$ISRSITE[inj.sub$DX1.3 == "821" | inj.sub$DX1.4 %betw1%
    c("8972", "8973") | inj.sub$DX1.5 == "92400" | inj.sub$DX1.5 ==
    "92800" | (inj.sub$DX1.3 == "945" & inj.sub$DX5 == "6")] <- 29

inj.sub$ISRSITE[inj.sub$DX1.3 == "822" | inj.sub$DX1.3 == "836" |
    inj.sub$DX1.4 %betw1% c("8440", "8443") | inj.sub$DX1.5 ==
    "92411" | inj.sub$DX1.5 == "92811" | (inj.sub$DX1.3 == "945" &
    inj.sub$DX5 == "5")] <- 30

inj.sub$ISRSITE[inj.sub$DX1.3 %betw1% c("823", "824") | inj.sub$DX1.4 %betw1%
```

```
    c("8970", "8971") | inj.sub$DX1.3 == "837" | inj.sub$DX1.4 ==
    "8450" | inj.sub$DX1.5 == "92410" | inj.sub$DX1.5 == "92421" |
    inj.sub$DX1.5 == "92810" | inj.sub$DX1.5 == "92821" | (inj.sub$DX1.3 ==
    "945" & inj.sub$DX5 %betw1% c("3", "4"))] <- 31

inj.sub$ISRSITE[inj.sub$DX1.3 %betw1% c("825", "826") | inj.sub$DX1.3 ==
    "838" | inj.sub$DX1.4 == "8451" | inj.sub$DX1.3 %betw1% c("892",
    "893") | inj.sub$DX1.3 %betw1% c("895", "896") | inj.sub$DX1.3 ==
    "917" | inj.sub$DX1.5 == "92420" | inj.sub$DX1.4 == "9243" |
    inj.sub$DX1.5 == "92820" | inj.sub$DX1.4 == "9283" | (inj.sub$DX1.3 ==
    "945" & inj.sub$DX5 %betw1% c("1", "2"))] <- 32

inj.sub$ISRSITE[inj.sub$DX1.3 == "827" | inj.sub$DX1.4 %betw1%
    c("8448", "8449") | inj.sub$DX1.3 %betw1% c("890", "891") |
    inj.sub$DX1.3 == "894" | inj.sub$DX1.4 %betw1% c("8974",
    "8977") | inj.sub$DX1.4 %betw1% c("9040", "9048") | inj.sub$DX1.3 ==
    "916" | inj.sub$DX1.4 %betw1% c("9244", "9245") | inj.sub$DX1.4 ==
    "9288" | inj.sub$DX1.4 == "9289" | inj.sub$DX1.4 %betw1%
    c("9596", "9597") | (inj.sub$DX1.3 == "945" & inj.sub$DX5 ==
    "0") | inj.sub$DX5 == "9"] <- 33

inj.sub$ISRSITE[inj.sub$DX1.3 == "828" | inj.sub$DX1.3 == "819" |
    inj.sub$DX1.5 == "90287" | inj.sub$DX1.5 == "90289" | inj.sub$DX1.4 ==
    "9538" | inj.sub$DX1.4 %betw1% c("9471", "9472") | inj.sub$DX1.3 ==
    "956"] <- 34

inj.sub$ISRSITE[inj.sub$DX1.3 == "829" | inj.sub$DX1.4 %betw1%
    c("8398", "8399") | inj.sub$DX1.4 %betw1% c("8488", "8489") |
    inj.sub$DX1.3 == "869" | inj.sub$DX1.4 %betw1% c("8798",
    "8799") | inj.sub$DX1.4 == "9029" | inj.sub$DX1.4 == "9049" |
    inj.sub$DX1.3 == "919" | inj.sub$DX1.4 %betw1% c("9248",
    "9249") | inj.sub$DX1.3 == "929" | inj.sub$DX1.3 == "946" |
    inj.sub$DX1.4 %betw1% c("9478", "9479") | inj.sub$DX1.3 %betw1%
    c("948", "949") | inj.sub$DX1.4 == "9539" | inj.sub$DX1.4 ==
    "9571" | inj.sub$DX1.4 %betw1% c("9578", "9579") | inj.sub$DX1.4 %betw1%
    c("9598", "9599")] <- 35

inj.sub$ISRSITE[inj.sub$DX1.3 %betw1% c("930", "939") | inj.sub$DX1.3 %betw1%
    c("960", "994") | inj.sub$DX1.3 %betw1% c("905", "908") |
    inj.sub$DX1.4 %betw1% c("9090", "9092") | inj.sub$DX1.3 ==
    "958" | inj.sub$DX1.5 %betw1% c("99554", "99550") | inj.sub$DX1.5 ==
    "99559" | inj.sub$DX1.4 == "9094" | inj.sub$DX1.4 == "9099" |
    inj.sub$DX1.5 %betw1% c("99580", "99585")] <- 36

table(inj.sub$ISRSITE)

# ISRSITE2
```

```
inj.sub$ISRSITE2[(inj.sub$ISRSITE >= 1 & inj.sub$ISRSITE <= 3)] <- 1
inj.sub$ISRSITE2[(inj.sub$ISRSITE >= 4 & inj.sub$ISRSITE <= 8)] <- 2
inj.sub$ISRSITE2[(inj.sub$ISRSITE >= 9 & inj.sub$ISRSITE <= 13)] <- 3
inj.sub$ISRSITE2[(inj.sub$ISRSITE >= 14 & inj.sub$ISRSITE <=
    18)] <- 4
inj.sub$ISRSITE2[(inj.sub$ISRSITE >= 19 & inj.sub$ISRSITE <=
    23)] <- 5
inj.sub$ISRSITE2[(inj.sub$ISRSITE >= 24 & inj.sub$ISRSITE <=
    27)] <- 6
inj.sub$ISRSITE2[(inj.sub$ISRSITE >= 28 & inj.sub$ISRSITE <=
    33)] <- 7
inj.sub$ISRSITE2[(inj.sub$ISRSITE >= 34 & inj.sub$ISRSITE <=
    35)] <- 8
inj.sub$ISRSITE2[inj.sub$ISRSITE == 36] <- 9


# ISRSITE3
inj.sub$ISRSITE3[(inj.sub$ISRSITE >= 1 & inj.sub$ISRSITE <= 8)] <- 1
inj.sub$ISRSITE3[(inj.sub$ISRSITE >= 9 & inj.sub$ISRSITE <= 18)] <- 2
inj.sub$ISRSITE3[(inj.sub$ISRSITE >= 19 & inj.sub$ISRSITE <=
    23)] <- 3
inj.sub$ISRSITE3[(inj.sub$ISRSITE >= 24 & inj.sub$ISRSITE <=
    33)] <- 4
inj.sub$ISRSITE3[(inj.sub$ISRSITE >= 34 & inj.sub$ISRSITE <=
    36)] <- 5


# create descriptive names for the codes above (NB: removed '
# & LATE EFFECTS' from 'SYSTEM WIDE' because those icd9 codes
# were removed when creating the data set)

# descriptors for ISRCODE
inj.sub$ISRCODE.descr[inj.sub$ISRCODE == 1] <- "FRACTURES "
inj.sub$ISRCODE.descr[inj.sub$ISRCODE == 2] <- "DISLOCATION"
inj.sub$ISRCODE.descr[inj.sub$ISRCODE == 3] <- "SPRAINS&STRAINS"
inj.sub$ISRCODE.descr[inj.sub$ISRCODE == 4] <- "INTERNAL ORGAN "
inj.sub$ISRCODE.descr[inj.sub$ISRCODE == 5] <- "OPEN WOUNDS"
inj.sub$ISRCODE.descr[inj.sub$ISRCODE == 6] <- "AMPUTATIONS"
inj.sub$ISRCODE.descr[inj.sub$ISRCODE == 7] <- "BLOOD VESSELS"
inj.sub$ISRCODE.descr[inj.sub$ISRCODE == 8] <- "SUPERFIC/CONT"
inj.sub$ISRCODE.descr[inj.sub$ISRCODE == 9] <- "CRUSHING"
inj.sub$ISRCODE.descr[inj.sub$ISRCODE == 10] <- "BURNS"
inj.sub$ISRCODE.descr[inj.sub$ISRCODE == 11] <- "NERVES"
inj.sub$ISRCODE.descr[inj.sub$ISRCODE == 12] <- "UNSPECIFIED"
inj.sub$ISRCODE.descr[inj.sub$ISRCODE == 13] <- "SYSTEM WIDE"
```

```
# descriptors for ISRSITE
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 1] <- "TYPE 1 TBI"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 2] <- "TYPE 2 TBI"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 3] <- "TYPE 3 TBI"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 4] <- "OTHER HEAD"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 5] <- "FACE"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 6] <- "EYE"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 7] <- "NECK"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 8] <- "HEAD,FACE,NECK UNSPEC"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 9] <- "CERVICAL SCI"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 10] <- "THORACIC/DORSAL SCI"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 11] <- "LUMBAR SCI"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 12] <- "SACRUM COCCYX SCI"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 13] <- "SPINE+BACK UNSPEC SCI"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 14] <- "CERVICAL VCI"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 15] <- "THORACIC/DORSAL VCI"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 16] <- "LUMBAR VCI"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 17] <- "SACRUM COCCYX VCI"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 18] <- "SPINE,BACK UNSPEC VCI"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 19] <- "CHEST"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 20] <- "ABDOMEN"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 21] <- "PELVIS+UROGENITAL"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 22] <- "TRUNK"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 23] <- "BACK+BUTTOCK"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 24] <- "SHOULDER&UPPER ARM"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 25] <- "FOREARM&ELBOW"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 26] <- "HAND&WRIST&FINGERS"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 27] <- "OTHER&UNSPEC UPPER EXTREM"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 28] <- "HIP"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 29] <- "UPPER LEG&THIGH"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 30] <- "KNEE"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 31] <- "LOWER LEG&ANKLE"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 32] <- "FOOT&TOES"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 33] <- "OTHER&UNSPEC LOWER EXTREM"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 34] <- "OTHER,MULTIPLE,NEC"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 35] <- "UNSPECIFIED"
inj.sub$ISRSITE.descr[inj.sub$ISRSITE == 36] <- "SYSTEM WIDE"


# descriptors for ISRSITE2
inj.sub$ISRSITE2.descr[inj.sub$ISRSITE2 == 1] <- "TBI"
inj.sub$ISRSITE2.descr[inj.sub$ISRSITE2 == 2] <- "OTH HEAD,FACE,NECK"
inj.sub$ISRSITE2.descr[inj.sub$ISRSITE2 == 3] <- "SCI"
inj.sub$ISRSITE2.descr[inj.sub$ISRSITE2 == 4] <- "VCI "
inj.sub$ISRSITE2.descr[inj.sub$ISRSITE2 == 5] <- "TORSO"
inj.sub$ISRSITE2.descr[inj.sub$ISRSITE2 == 6] <- "UPPER EXTREMITY"
inj.sub$ISRSITE2.descr[inj.sub$ISRSITE2 == 7] <- "LOWER EXTREMITY"
```

```
inj.sub$ISRSITE2.descr[inj.sub$ISRSITE2 == 8] <- "OTHER & UNSPECIFIED"
inj.sub$ISRSITE2.descr[inj.sub$ISRSITE2 == 9] <- "SYSTEM WIDE"

# descriptors for ISRSITE3
inj.sub$ISRSITE3.descr[inj.sub$ISRSITE3 == 1] <- "HEAD&NECK"
inj.sub$ISRSITE3.descr[inj.sub$ISRSITE3 == 2] <- "SPINE&BACK"
inj.sub$ISRSITE3.descr[inj.sub$ISRSITE3 == 3] <- "TORSO"
inj.sub$ISRSITE3.descr[inj.sub$ISRSITE3 == 4] <- "EXTREMITIES"
inj.sub$ISRSITE3.descr[inj.sub$ISRSITE3 == 5] <- "UNCLASSIFIABLE BY SITE"


table(inj.sub$ISRSITE3.descr)
table(inj.sub$ISRSITE2.descr)
table(inj.sub$ISRSITE.descr)
table(inj.sub$ISRCODE.descr)

table(inj.sub$ISRCODE.descr, inj.sub$ISRSITE2.descr)

saveRDS(inj.sub, "~/nis.00_11.inj.rds")
```

4.3 ICISS

The ICD-derived ISS (ICISS) proposed by Osler et al in 1996 based on so-called "survival risk ratios" which are "...calculated as the ratio of the number of times of a given ICD-9 code occurs in a surviving patient to the total number of occurances of that code. The ICISS is defined as the product of all the survival risk ratios for each of an individual patient's injuries (for as many as ten different injuries)" (M. Segui Gomez, p291, in Li and Baker) Severe injuries posited as those below 0.94 (see http://www.cdc.gov/nchs/injury/ice/boston2009/boston2009_proceedings.htm#proceeding_20) and have also been categorized as Minor (ICISS 0.941 to 1.0), Moderate (ICISS 0.665 to 0.940), Serious (ICISS 0.355 to 0.664), Severe (ICISS 0.220 to 0. 354), and Critical (ICISS 0 to 0.219) (Ordered risk categories for the ICD-based injury severity score (ICISS) http://www.cdc.gov/nchs/injury/ice/boston2009/boston2009_proceedings.htm#proceeding_20)

```
inj.sub <- inj
rm(inj)
inj.sub <- inj.sub[, -(188:199)]

# inj.sub<-inj[sample(nrow(inj),10000),]

injury.codes <- as.character(c(800:996, 8000:9960, 80000:99600))

lateEffects <- as.character(c(9050:9099))
insectBites <- as.character(c(9104, 9105, 9114, 9115, 9124, 9125,
    9134, 9135, 9144, 9145, 9154, 9155, 9164, 9165, 9174, 9175,
```

```
    9194, 9195))
poisoning <- as.character(c(9600:9649, 96500:96502, 96509, 9651,
    9654, 9655, 96561, 96569, 9657:9690, 96900:96909, 96970:96973,
    9691:9697, 9670:9679, 96979, 9698:9809, 97081, 97089, 981,
    9820:9859, 986, 9870:9897, 98981:98989, 9899, 990, 9910:9952,
    99520:99529, 9953, 9954))
anaphylaxis <- as.character(c(99560:99569, 9957))
misc <- as.character(c(99586:99600))
non.trauma <- c(lateEffects, insectBites, poisoning, anaphylaxis,
    misc)

injury.codes <- injury.codes[!injury.codes %in% non.trauma]

length(injury.codes)  # 21,300
length(unique(inj$DX1))  # 2006 , many fewer injury dx's why better to apply original coding to subseq

# create trauma diagnoses from which to calculate srr's
inj.sub$DX2.T <- ifelse(inj.sub$DX2 %in% injury.codes, inj.sub$DX2,
    NA)
inj.sub$DX3.T <- ifelse(inj.sub$DX3 %in% injury.codes, inj.sub$DX3,
    NA)
inj.sub$DX4.T <- ifelse(inj.sub$DX4 %in% injury.codes, inj.sub$DX4,
    NA)
inj.sub$DX5.T <- ifelse(inj.sub$DX5 %in% injury.codes, inj.sub$DX5,
    NA)
inj.sub$DX6.T <- ifelse(inj.sub$DX6 %in% injury.codes, inj.sub$DX6,
    NA)
inj.sub$DX7.T <- ifelse(inj.sub$DX7 %in% injury.codes, inj.sub$DX7,
    NA)
inj.sub$DX8.T <- ifelse(inj.sub$DX8 %in% injury.codes, inj.sub$DX8,
    NA)
inj.sub$DX9.T <- ifelse(inj.sub$DX9 %in% injury.codes, inj.sub$DX9,
    NA)
inj.sub$DX10.T <- ifelse(inj.sub$DX10 %in% injury.codes, inj.sub$DX10,
    NA)

# calculate srr's from DX1
srrDx1.1 <- as.data.frame(table(inj.sub$DX1[inj.sub$DIED == 0]))  # use table() to count up all patier
srrDx1.2 <- as.data.frame(table(inj.sub$DX1))  # count up all patients with the diagnosis
srrDx1.3 <- merge(srrDx1.1, srrDx1.2, by = "Var1", all = TRUE)  # create single file, first column the

names(srrDx1.3) <- c("ICD", "Surv", "Tot")  # rename
srrDx1.3$Surv[is.na(srrDx1.3$Surv)] <- 0  # set NA's to zero to allow calculations
# srrDx1.3$srr<-srrDx1.3$Surv/srrDx1.3$Tot # calculate the
# srr for the dx srrDx1.3<-srrDx1.3[,-c(2,3)] # remove the
# first two columns of counts
```

```
##############################################

# calculate srr's from DX2
srrDx2.1 <- as.data.frame(table(inj.sub$DX2.T[inj.sub$DIED ==
    0]))
srrDx2.2 <- as.data.frame(table(inj.sub$DX2.T))
srrDx2.3 <- merge(srrDx2.1, srrDx2.2, by = "Var1", all = TRUE)

names(srrDx2.3) <- c("ICD", "Surv", "Tot")
srrDx2.3$Surv[is.na(srrDx2.3$Surv)] <- 0
# srrDx2.3$srr<-srrDx2.3$Surv/srrDx2.3$Tot
# srrDx2.3<-srrDx2.3[,-c(2,3)]

##############################################

# calculate srr's from DX3
srrDx3.1 <- as.data.frame(table(inj.sub$DX3.T[inj.sub$DIED ==
    0]))
srrDx3.2 <- as.data.frame(table(inj.sub$DX3.T))
srrDx3.3 <- merge(srrDx3.1, srrDx3.2, by = "Var1", all = TRUE)

names(srrDx3.3) <- c("ICD", "Surv", "Tot")
srrDx3.3$Surv[is.na(srrDx3.3$Surv)] <- 0
# srrDx3.3$srr<-srrDx3.3$Surv/srrDx3.3$Tot
# srrDx3.3<-srrDx3.3[,-c(2,3)]

############################################## calculate srr's from DX4
srrDx4.1 <- as.data.frame(table(inj.sub$DX4.T[inj.sub$DIED ==
    0]))
srrDx4.2 <- as.data.frame(table(inj.sub$DX4.T))
srrDx4.3 <- merge(srrDx4.1, srrDx4.2, by = "Var1", all = TRUE)

names(srrDx4.3) <- c("ICD", "Surv", "Tot")
srrDx4.3$Surv[is.na(srrDx4.3$Surv)] <- 0
# srrDx4.3$srr<-srrDx4.3$Surv/srrDx4.3$Tot
# srrDx4.3<-srrDx4.3[,-c(2,3)]

##############################################

# calculate srr's from DX5
srrDx5.1 <- as.data.frame(table(inj.sub$DX5.T[inj.sub$DIED ==
    0]))
srrDx5.2 <- as.data.frame(table(inj.sub$DX5.T))
srrDx5.3 <- merge(srrDx5.1, srrDx5.2, by = "Var1", all = TRUE)

names(srrDx5.3) <- c("ICD", "Surv", "Tot")
srrDx5.3$Surv[is.na(srrDx5.3$Surv)] <- 0
```

```
# srrDx5.3$srr<-srrDx5.3$Surv/srrDx5.3$Tot
# srrDx5.3<-srrDx5.3[,-c(2,3)]

##############################################

# calculate srr's from DX6
srrDx6.1 <- as.data.frame(table(inj.sub$DX6.T[inj.sub$DIED ==
    0]))
srrDx6.2 <- as.data.frame(table(inj.sub$DX6.T))
srrDx6.3 <- merge(srrDx6.1, srrDx6.2, by = "Var1", all = TRUE)

names(srrDx6.3) <- c("ICD", "Surv", "Tot")
srrDx6.3$Surv[is.na(srrDx6.3$Surv)] <- 0
# srrDx6.3$srr<-srrDx6.3$Surv/srrDx6.3$Tot
# srrDx6.3<-srrDx6.3[,-c(2,3)]

##############################################

# calculate srr's from DX7
srrDx7.1 <- as.data.frame(table(inj.sub$DX7.T[inj.sub$DIED ==
    0]))
srrDx7.2 <- as.data.frame(table(inj.sub$DX7.T))
srrDx7.3 <- merge(srrDx7.1, srrDx7.2, by = "Var1", all = TRUE)

names(srrDx7.3) <- c("ICD", "Surv", "Tot")
srrDx7.3$Surv[is.na(srrDx7.3$Surv)] <- 0
# srrDx7.3$srr<-srrDx7.3$Surv/srrDx7.3$Tot
# srrDx7.3<-srrDx7.3[,-c(2,3)]

##############################################

# calculate srr's from DX8
srrDx8.1 <- as.data.frame(table(inj.sub$DX8.T[inj.sub$DIED ==
    0]))
srrDx8.2 <- as.data.frame(table(inj.sub$DX8.T))
srrDx8.3 <- merge(srrDx8.1, srrDx8.2, by = "Var1", all = TRUE)

names(srrDx8.3) <- c("ICD", "Surv", "Tot")
srrDx8.3$Surv[is.na(srrDx8.3$Surv)] <- 0
# srrDx8.3$srr<-srrDx8.3$Surv/srrDx8.3$Tot
# srrDx8.3<-srrDx8.3[,-c(2,3)]

##############################################

# calculate srr's from DX9
srrDx9.1 <- as.data.frame(table(inj.sub$DX9.T[inj.sub$DIED ==
    0]))
```

```
srrDx9.2 <- as.data.frame(table(inj.sub$DX9.T))
srrDx9.3 <- merge(srrDx9.1, srrDx9.2, by = "Var1", all = TRUE)

names(srrDx9.3) <- c("ICD", "Surv", "Tot")
srrDx9.3$Surv[is.na(srrDx9.3$Surv)] <- 0
# srrDx9.3$srr<-srrDx9.3$Surv/srrDx9.3$Tot
# srrDx9.3<-srrDx9.3[,-c(2,3)]

##############################################

# calculate srr's from DX10
srrDx10.1 <- as.data.frame(table(inj.sub$DX10.T[inj.sub$DIED ==
    0]))
srrDx10.2 <- as.data.frame(table(inj.sub$DX10.T))
srrDx10.3 <- merge(srrDx10.1, srrDx10.2, by = "Var1", all = TRUE)

names(srrDx10.3) <- c("ICD", "Surv", "Tot")
srrDx10.3$Surv[is.na(srrDx10.3$Surv)] <- 0
# srrDx10.3$srr<-srrDx10.3$Surv/srrDx10.3$Tot
# srrDx10.3<-srrDx10.3[,-c(2,3)]

##############################################


# merge all the individual dx data sets

merged.srrDxs.1 <- merge(srrDx1.3, srrDx2.3, by = "ICD", all = T)
merged.srrDxs.2 <- merge(srrDx3.3, srrDx4.3, by = "ICD", all = T)
merged.srrDxs.3 <- merge(srrDx5.3, srrDx6.3, by = "ICD", all = T)
merged.srrDxs.4 <- merge(srrDx7.3, srrDx8.3, by = "ICD", all = T)
merged.srrDxs.5 <- merge(srrDx9.3, srrDx10.3, by = "ICD", all = T)

merged.srrDxs.6 <- merge(merged.srrDxs.1, merged.srrDxs.2, by = "ICD",
    all = T)
merged.srrDxs.7 <- merge(merged.srrDxs.3, merged.srrDxs.4, by = "ICD",
    all = T)
merged.srrDxs.8 <- merge(merged.srrDxs.6, merged.srrDxs.7, by = "ICD",
    all = T)

merged.srrDxs.9 <- merge(merged.srrDxs.8, merged.srrDxs.5, by = "ICD",
    all = T)

merged.srrDxs.9 <- replace(merged.srrDxs.9, is.na(merged.srrDxs.9),
    0)

merged.srrDxs.9$Tot <- rowSums(merged.srrDxs.9[, c(3, 5, 7, 9,
    11, 13, 15, 17, 19, 21)], na.rm = T)
```

```
merged.srrDxs.9$Surv <- rowSums(merged.srrDxs.9[, c(2, 4, 6,
    8, 10, 12, 14, 16, 18, 20)], na.rm = T)
merged.srrDxs.9$srr <- merged.srrDxs.9$Surv/merged.srrDxs.9$Tot

srr <- merged.srrDxs.9[, c("ICD", "srr")]

# save the srr file

write.csv(srr, file = "~/nis.00_11.ssrs.csv")

# merge the srr to the original dataframe matching on the ICD
# code
inj.sub <- merge(x = as.data.frame(inj.sub), y = srr, by.x = "DX1",
   by.y = "ICD", all.x = T)  # need as.data.frame because data.table merge doesn't recognize by.x and
names(inj.sub)[names(inj.sub) == "srr"] <- "srr1"

inj.sub <- merge(x = as.data.frame(inj.sub), y = srr, by.x = "DX2.T",
    by.y = "ICD", all.x = T)
names(inj.sub)[names(inj.sub) == "srr"] <- "srr2"

inj.sub <- merge(x = as.data.frame(inj.sub), y = srr, by.x = "DX3.T",
    by.y = "ICD", all.x = T)
names(inj.sub)[names(inj.sub) == "srr"] <- "srr3"

inj.sub <- merge(x = as.data.frame(inj.sub), y = srr, by.x = "DX4.T",
    by.y = "ICD", all.x = T)
names(inj.sub)[names(inj.sub) == "srr"] <- "srr4"

inj.sub <- merge(x = as.data.frame(inj.sub), y = srr, by.x = "DX5.T",
    by.y = "ICD", all.x = T)
names(inj.sub)[names(inj.sub) == "srr"] <- "srr5"

inj.sub <- merge(x = as.data.frame(inj.sub), y = srr, by.x = "DX6.T",
    by.y = "ICD", all.x = T)
names(inj.sub)[names(inj.sub) == "srr"] <- "srr6"

inj.sub <- merge(x = as.data.frame(inj.sub), y = srr, by.x = "DX7.T",
    by.y = "ICD", all.x = T)
names(inj.sub)[names(inj.sub) == "srr"] <- "srr7"

inj.sub <- merge(x = as.data.frame(inj.sub), y = srr, by.x = "DX8.T",
    by.y = "ICD", all.x = T)
names(inj.sub)[names(inj.sub) == "srr"] <- "srr8"

inj.sub <- merge(x = as.data.frame(inj.sub), y = srr, by.x = "DX9.T",
    by.y = "ICD", all.x = T)
names(inj.sub)[names(inj.sub) == "srr"] <- "srr9"
```

```
inj.sub <- merge(x = as.data.frame(inj.sub), y = srr, by.x = "DX10.T",
    by.y = "ICD", all.x = T)
names(inj.sub)[names(inj.sub) == "srr"] <- "srr10"

# calculate iciss as product of ssr's
inj.sub$iciss <- apply(inj.sub[, c("srr1", "srr2", "srr3", "srr4",
    "srr5", "srr6", "srr7", "srr8", "srr9", "srr10")], 1, prod,
    na.rm = T)
```

4.4 Charlson Index

Use icd9::icd9Charlson() to calculate Charlson score for each patient in the individual data set. First create a data frame limited to identifier and diagnostic codes. Convert this dataframe from a wide to a long format, Then apply the function [9]

```
charlDat<-data.frame(inj[,c("KEY", "DX1","DX2","DX3","DX4", "DX5","DX6","DX7","DX8","DX9", "DX10","D

charlDat2<-reshape(charlDat, direction="long",
  varying = list(c("DX1","DX2","DX3","DX4", "DX5","DX6","DX7","DX8","DX9", "DX10","DX11","DX12","DX1
  v.names = "ICD9",new.row.names = 1:(25*(nrow(charlDat))), #NB have to set series of unique row names
 idvar="KEY")

 # remove rows with missing ICD9
charlDat2<-charlDat2[!is.na(charlDat2$ICD9),]

# try with icd9::icd9Charlson()
injCharlson<-icd9Charlson(charlDat2,visitId = "KEY", return.df = TRUE)

# merge back to original data set

inj2<-merge(x=inj, y=injCharlson, by="KEY", all.x=T)

saveRDS(inj2, "~/nis.00_11.inj.rds")
```

4.5 create diagnosis count files

```
# Create a table of counts by ICD9 injury code and used
# icd9::icdExplain to append a brief description to each.
tab1 <- svytable(~DX1 + YEAR, injsvy, round = T)
tab1 <- as.data.frame.matrix(tab1)
tab1$ICD9 <- rownames(tab1)
```

[9] First pass tried using R package "medicalrisk" without success. I think it didn't read the icd9 codes well.

```
# use icd9::icd9Explain() to add dx descriptions to icd9
# codes (note: loop because apply would not accept
# icd9Explain as a fx...)
for (i in 1:nrow(tab1)) {
    tab1$Description[i] <- icd9Explain(tab1$ICD9[i], brief = T)
}

sum(colSums(tab1[, 1:12]))  #18,720,525

write.csv(tab1, "~/nis.00_11.icdInjCounts.csv")
```

4.6 creating ecode files

```
# PRIMARY ECODES BY YEAR more complicated than icd9's because
# of presence of invalid codes
tab1 <- svytable(~ECODE1 + YEAR, injsvy, round = T)
tab1 <- as.data.frame.matrix(tab1)

tab1$Ecode1 <- rownames(tab1)  # create variable with ecodes (ended up as rownames from the survey tab
tab1 <- tab1[-c(1, nrow(tab1)), ]  # remove invalid and missing codes (first and last)

tab1$Ecode1[nchar(tab1$Ecode1) == 4] <- paste(tab1$Ecode1[nchar(tab1$Ecode1) ==
    4], "0", sep = "")  # convert ecodes to valid decimal format
tab1$Ecode1 <- paste(substring(tab1$Ecode1, 1, 4), ".", substring(tab1$Ecode1,
    5, 5), sep = "")

sum(icd9IsValidDecimal(tab1$Ecode1))  # all are valid, but some are non-existent

nrow(tab1)  # 1083

# print them all out, invalid codes return 'character (0)'
for (i in 1:nrow(tab1)) {
    print(icd9ExplainDecimal(tab1$Ecode1[i], brief = T, doCondense = FALSE))
}

# spent several hours trying to get icd9Explain to play
# nicely with apply() or with a loop; seems the character(0)
# returns broke things, in the ended, decided to just win
# ugly.  created a vector by printing out the descriptions,
# cutting and pasting into textmate, removing all the [1]'s,
# replacing character(0) with NA, replacing end of line regex
# $ with a comma, and removing regex \n line breakes

Descriptions <- c("Civilian activity-income", "Military activity",
    "Volunteer activity", "Externl cause status NEC", "Externl cause status NOS",
    "Walking,marching,hiking", "Running", "Swimming", "Springboard/platfrm dive",
```

```
    "Underwater dive/snorkel", "Row,canoe,kayk,raft,tube", "Water ski/wake boarding",
    "Surf,windsrf,boogie brd", "Water sliding", "Water/watercraft",
    "Ice Skating", "Ice hockey", "Ski,snow brd,sled,tobagn",
    "Ice and snow", "Mountain,rock/wall climb", "BASE jumping",
    "Hang gliding", "Climb,rappell,jump off", "Dancing", "Yoga",
    "Gymnastics", "Trampoline", "Cheerleading", "Dancing,rhythm movements",
    "Roller skate,skateboard", "Horseback riding", "Golf", "Bowling",
    "Bike riding", "Jumping rope", "Non-running track/field",
    "Individ sports,athletics", "Tackle football", "Amer flag/touch football",
    "Rugby", "Baseball", "Lacrosse,field hockey", "Soccer", "Basketball",
    "Volleyball (beach,court)", "School recess,camp", "Team sports,athletes",
    "Boxing", "Wrestling", "Racquet/hand sports", "Frisbee",
    "Martial arts", "Sports,athletics NEC", "Exercise mach(cardiorsp)",
    "Aerobic,step exercise", "Cardioresp exercise NEC", "Muscle strength mach",
    "Push-ups,pull-ups,sit-up", "Free weights", "Pilates", "Muscle strength exer NEC",
    "Personal bathing/shower", "Laundry", "Vacuuming", "Floor mopping/cleaning",
    "Residential relocation", "Personal hygiene NEC", "Househld maintenance NEC",
    "Caregiving-lifting", "Caregiving NEC", "Food prep & cleanup",
    "Grilling & smoking food", "Cooking & baking", "Cooking & grilling NEC",
    "Digging,shovel,rake", "Gardening/landscaping", "Building & construction",
    "Land maintain/cnstrt NEC", "Roller coaster riding", "External motion NEC",
    "Walking an animal", "Animal care NEC", "Refereeing sports",
    "Spectator at event", "Rough housing/horseplay", "Activity NEC",
    NA, "RR collision NOS-employ", "RR coll NOS-passenger", "RR coll NOS-pedestrian",
    "RR coll NOS-ped cyclist", "RR coll NOS-person NEC", "RR coll NOS-person NOS",
   "RR coll w oth obj-employ", "RR coll w oth obj-pasngr", "RR coll w oth obj-pedest",
    "RR coll w oth obj-cycl", "RR col w oth obj-per NEC", "RR acc w derail-employee",
    "RR acc w derail-passeng", "RR acc w derail-pedest", "RR acc w explosion-empl",
    "Fall on/from train-empl", "Fall from train-passengr", "Fall from train-pedest",
    "Fall from train-pers NEC", "Fall from train-pers NOS", "Hit by train-employee",
    "Hit by train-passenger", "Hit by train-pedestrian", "Hit by train-ped cyclist",
    "Hit by train-person NEC", "Hit by train-person NOS", "RR acc NEC-employee",
    "RR acc NEC-passenger", "RR acc NEC-pedestrian", "RR acc NEC-ped cyclist",
    "RR acc NEC-person NEC", "RR acc NEC-person NOS", "RR accident NOS-employee",
    "RR acc NOS-passenger", "RR acc NOS-pedestrian", "RR acc NOS-person NEC",
    "RR acc NOS-person NOS", "Mv-train coll-driver", "Mv-train coll-pasngr",
    "Mv-train coll-motorcycl", "Mv-train coll-mcycl psgr", "Mv-train coll-anim rid",
    "Mv-train coll-ped cycl", "Mv-train coll-pedest", "Mv-train coll-pers NEC",
    "Mv-train coll-pers NOS", "Reentrant mv coll-driver", "Reentrant mv coll-pasngr",
    "Reentrant coll-motcycl", "Reentrant coll-mcyc psgr", "Reentrant coll-ped cycl",
    "Reentrant coll-pedest", "Reentrant coll-pers NEC", "Reentrant coll-pers NOS",
    "Mv collision NOS-driver", "Mv collision NOS-pasngr", "Mv collis NOS-motorcycl",
    "Mv coll NOS-mcycl psngr", "Mv collision NOS-st car", "Mv coll NOS-anim rid",
    "Mv coll NOS-ped cycl", "Mv collision NOS-pedest", "Mv collis NOS-pers NEC",
    "Mv collis NOS-pers NOS", "Mv-oth veh coll-driver", "Mv-oth veh coll-pasngr",
    "Mv-oth veh coll-motcycl", "Mv-oth veh coll-mcyc psg", "Mv-oth veh coll-st car",
    "Mv-oth veh coll-anim rid", "Mv-oth veh coll-ped cycl", "Mv-oth veh coll-pedest",
```

```
"Mv-oth veh coll-pers NEC", "Mv-oth veh coll-pers NOS", "Mv coll w pedest-driver",
"Mv coll w pedest-pasngr", "Mv coll w pedest-motcycl", "Mv coll w ped-mcycl psgr",
"Mv coll w pedest-st car", "Mv coll w ped-anim rid", "Mv coll w ped-ped cycl",
"Mv coll w pedest-pedest", "Mv coll w pedes-pers NEC", "Mv coll w pedes-pers NOS",
"Mv coll w oth obj-driver", "Mv coll w oth obj-pasngr", "Mv coll w oth obj-mocycl",
"Mv coll w obj-mcycl psgr", "Mv coll w obj-st car", "Mv coll w obj-anim rider",
"Mv coll w obj-ped cycl", "Mv coll w obj-pedest", "Mv coll w obj-pers NEC",
"Mv coll w obj-pers NOS", "Loss control mv acc-driv", "Loss control mv acc-psgr",
"Loss control mv-mocycl", "Loss control mv-mcyc psg", "Loss cont mv acc-st car",
"Loss cont mv-anim rider", "Loss control mv-ped cycl", "Loss control mv-pedest",
"Loss control mv-pers NEC", "Loss control mv-pers NOS", "Mv acc board/alight-driv",
"Mv acc board/alight-psgr", "Mv board/alight-motcycl", "Mv brd/alight-mcycl psgr",
"Mv acc brd/alight-st car", "Mv brd/alight-anim rider", "Mv brd/alight-ped cycl",
"Mv brd/alight-pedestrian", "Mv board/alight-pers NEC", "Mv board/alight-pers NOS",
"Mv traff acc NEC-driver", "Mv traff acc NEC-pasngr", "Mv traff acc NEC-mocycl",
"Mv traff acc-mcycl psgr", "Mv traff acc NEC-st car", "Mv traff acc-anim rider",
"Mv traff acc-ped cyc", "Mv traff acc NEC-pedest", "Mv traff acc-pers NEC",
"Mv traff acc-pers NOS", "Traffic acc NOS-driver", "Traffic acc NOS-pasngr",
"Traffic acc NOS-motcycl", "Traff acc NOS-mcycl psgr", "Traffic acc NOS-st car",
"Traff acc NOS-anim rider", "Traffic acc NOS-ped cycl", "Traffic acc NOS-pedest",
"Traffic acc NOS-pers NEC", "Traffic acc NOS-pers NOS", "Snow veh acc-driver",
"Snow veh acc-pasngr", "Snow veh acc-motorcycl", "Snow veh acc-mcycl psgr",
"Snow veh acc-pedest", "Snow veh acc-pers NEC", "Snow veh acc-pers NOS",
"Oth off-road mv acc-driv", "Oth off-road mv acc-psgr", "Oth off-road mv-mocycl",
"Oth off-road mv-mcyc psg", "Oth off-road mv-st car", "Oth off-road mv-anim rid",
"Oth off-road mv-ped cycl", "Oth off-road mv-pedest", "Oth off-road mv-pers NEC",
"Oth off-road mv-pers NOS", "Oth coll w mov obj-driv", "Oth coll w mov obj-psgr",
"Oth coll mov obj-mocycl", "Oth coll mov obj-cyc psg", "Oth coll mov obj-rider",
"Oth coll mov obj-ped cyc", "Oth coll mov obj-pedest", "Oth coll mov obj-per NEC",
"Oth coll mov obj-per NOS", "Oth coll stndng obj-driv", "Oth coll stndng obj-psgr",
"Oth coll stnd obj-mocycl", "Oth coll stn obj-cyc psg", "Oth coll stnd obj-st car",
"Oth coll stnd obj-rider", "Oth coll stn obj-ped cyc", "Oth coll stnd obj-pedest",
"Oth coll stn obj-per NEC", "Oth col-stnd-obj-per NOS", "N-traf board/alight-driv",
"N-traf board/alight-psgr", "N-traf brd/alight-mocycl", "N-traf brd/alit-mcyc psg",
"N-traf brd/alit-st car", "N-traf brd/alit-anim rid", "N-traf brd/alit-ped cycl",
"N-traf brd/alit-pedest", "N-traf brd/alit-pers NEC", "N-traf brd/alit-pers NOS",
"Mv n-traff acc NEC-driv", "Mv n-traff NEC/NOS-psgr", "Mv n-traf acc NEC-mocycl",
"Mv n-traff NEC-mcyc psgr", "Mv n-traff NEC-st car", "Mv n-traf NEC-anim rider",
"Mv n-traff NEC-ped cycl", "Mv n-traff NEC-pedest", "Mv n-traff NEC-pers NEC",
"Mv n-traff NEC-pers NOS", "Pedal cycle acc-pedest", "Ped cycl acc-ped cyclist",
"Ped cycle acc-anim rider", "Ped cyc acc-occ anim veh", "Ped cycle acc-occ st car",
"Ped cycle acc-pers NEC", "Ped cycle acc-pers NOS", "Animal drawn veh-pedest",
"Anim drawn veh-anim rid", "Animal drawn veh-occupan", "Anim drawn veh-pers NEC",
"Anim drawn veh-pers NOS", "Ridden animal acc-pedest", "Ridden animal acc-rider",
"Ridden animal acc-st car", "Ridden anim acc-pers NEC", "Ridden anim acc-pers NOS",
"Oth road veh acc-pedest", "Oth rd veh acc-st car", "Oth rd veh acc-pers NEC",
"Oth rd veh acc-pers NOS", "Boat acc w submers-unpow", "Boat acc w submers-power",
```

```
  "Boat acc w submers-crew", "Boat acc w submers-psgr", "Boat submers-water skier",
  "Boat submers-swimmer", "Boat submers-pers NEC", "Boat submers-pers NOS",
  "Boat acc inj NEC-unpower", "Boat acc inj NEC-power", "Boat acc inj NEC-crew",
  "Boat acc inj NEC-passeng", "Boat acc inj NEC-skier", "Boat acc inj NEC-swim",
  "Boat acc inj NEC-docker", "Boat inj NEC-person NEC", "Boat inj NEC-person NOS",
  "Submers NEC-unpow boat", "Submers NEC-power boat", "Submers NEC-crew",
  "Submers NEC-passenger", "Submers NEC-water skier", "Submers NEC-swimmer",
  "Submers NEC-docker", "Submers NEC-person NEC", "Submers NEC-person NOS",
 "W/craft stair fall-unpow", "W/craft stair fall-power", "Wtrcraft stair fall-crew",
 "Wtrcraft stair fall-psgr", "W/craft stair fall-skier", "W/crf stair fall-per NEC",
 "W/crf stair fall-per NOS", "W/craft fall NEC-unpow", "W/craft fall NEC-power",
 "Watercraft fall NEC-crew", "Wtrcraft fall NEC-pasngr", "W/craft fall NEC-skier",
 "W/craft fall NEC-swim", "Wtrcraft fall NEC-docker", "W/crft fall NEC-pers NEC",
 "W/crft fall NEC-pers NOS", "W/craft fall NOS-unpow", "W/craft fall NOS-power",
 "Wtrcraft fall NOS-crew", "Wtrcraft fall NOS-pasngr", "W/craft fall NOS-skier",
 "W/craft fall NOS-swim", "Wtrcraft fall NOS-docker", "W/crft fall NEC/NOS-mil",
 "W/crft fall NOS-pers NEC", "W/crft fall NOS-pers NOS", "Machine acc-unpow boat",
 "Mach acc-occ power boat", "Machinery accident-crew", "Machinery acc-pasngr",
 "Machine accident-skier", "Machine accident-swim", "Machinery acc-docker",
 "Machinery acc-pers NEC", "Machinery acc-pers NOS", "Explosion-occ unpow boat",
 "Explosion-occ power boat", "Watercraft explos-crew", "Watercraft explos-pasngr",
 "Watercraft explos-skier", "Watercraft explos-docker", "Watercraft expl-pers NEC",
"Watercraft expl-pers NOS", "Watercraft acc NEC-unpow", "Watercraft acc NEC-power",
 "Watercraft acc NEC-crew", "Watercrft acc NEC-pasngr", "Watercraft acc NEC-skier",
"Watrcrft acc NEC-swimmer", "Watercrft acc NEC-docker", "Wtrcrft acc NEC-pers NEC",
 "Wtrcrft acc NEC-pers NOS", "Tk off/land-spcrft", "Tk off/land-milit craft",
"Tk off/land-crew aircrft", "Tk off/land-psng aircrft", "Tk off/land-aircraft NEC",
 "Tk off/land-unp aircrft", "Tk off/land-parachutist", "Tk off/land-ground crew",
 "Tk off/land-pers NEC", "Pow aircraft acc-spcrft", "Power aircraft acc-milit",
 "Power aircraft acc-crew", "Power aircraft acc-psngr", "Aircraf acc-occ comm NEC",
"Oth powered aircraft acc", "Aircraft acc-parachutist", "Aircraft acc-ground crew",
"Aircrft acc NOS-pers NEC", "Unpower aircraft acc-occ", "Unpow aircrf acc-chutist",
"Unpow aircrf acc-gr crew", "Unpow aircrf acc-per NEC", "Fall-milit aircraft occp",
 "Fall-crew comm aircraft", "Fall-psng comm aircraft", "Fall-occ comm aircrf NEC",
 "Fall-occup oth aircraft", "Fall-occ unpower aircraf", "Fall-parachutist",
 "Aircrft fall-ground crew", "Aircraft fall-person NEC", "Aircrft acc NEC-spcrft",
 "Aircrft acc NEC-military", "Aircrft acc NEC-crew", "Aircrft acc NEC-pasngr",
 "Aircrft acc NEC-comm NEC", "Aircrft acc NEC-occp NEC", "Aircr acc NEC-unp aircr",
 "Aircrft acc-parachutist", "Aircrft acc NEC-grd crew", "Aircrft acc NEC-pers NEC",
 "Spacecraft acc-occupant", "Spacecraft acc-pers NEC", NA,
 NA, NA, "Accident in home", "Accident on farm", "Accident in mine/quarry",
 "Acc on industr premises", "Accid in recreation area", "Accid on street/highway",
 "Accident in public bldg", "Accid in resident instit", "Accident in place NEC",
 "Accident in place NOS", "Acc poison-heroin", "Acc poison-methadone",
 "Acc poison-opiates NEC", "Acc poison-salicylates", "Acc poison-arom analgesc",
"Acc poison-nonnarc analg", "Acc poison-analgesic NEC", "Acc poison-analgesic NOS",
 NA, "Acc poison-sedatives NEC", "Acc poison-sedatives NOS",
```

```
  "Acc pois-butyrphen tranq", "Acc poisn-benzdiaz tranq", "Acc poisn-tranquilzr NEC",
 "Acc poison-antidepressnt", "Acc poison-hallucinogens", "Acc poisn-psychstimulant",
 "Acc poison-cns stimulant", "Acc poisn psychotrop NEC", "Acc poisn-anticonvulsant",
  "Acc poisn-cns depres NEC", "Acc poisn-local anesthet", "Acc poisn-anticholinerg",
  "Acc poison-cns drug NEC", "Acc poison-cns drug NOS", NA,
  NA, "Acc poison-hormones", "Acc poisn-systemic agent", "Acc poison-blood agent",
  "Acc poisn-cardiovasc agt", "Acc poison-gi agent", "Acc poisn-metabol agnt",
  "Acc poisn-muscl/resp agt", "Acc poisn-skin/eent agnt", "Acc poisoning-drug NEC",
  "Acc poisoning-drug NOS", "Acc poisn-alcohol bevrag", "Acc poison-ethyl alcohol",
  "Acc poisn-methyl alcohol", "Acc poisn-isopropyl alc", "Acc poison-alcohol NEC",
  "Acc poison-alcohol NOS", "Acc pois-synth detergent", "Acc poison-polishes",
  "Acc poison-cleanser NEC", "Acc poison-disinfectants", "Acc poison-lead paints",
  "Acc poison-paints NEC", "Acc poison-cleanser NOS", "Acc poisn-petroleum fuel",
  "Acc poisn-solvents NEC", "Acc poisn-solvent NOS", "Acc poison-herbicides",
  "Acc poison-fungicides", "Acc poison-rodenticides", "Acc pois-corrosiv aromat",
  "Acc poison-acids", "Acc poisn-caustic alkali", "Acc poison-caustic NEC",
  "Acc poison-caustic NOS", "Acc poison-meat", "Acc poison-shellfish",
  "Acc poison-fish NEC", "Acc poison-plants NEC", "Acc poison-food NEC",
  "Acc poisn-food/plant NOS", "Acc poisoning-lead", "Acc poisoning-mercury",
  "Acc poison-metals NEC", "Acc poison-glues", "Acc pois-solid/liq NEC",
  "Acc pois-solid/liq NOS", NA, "Acc pois-liq petrol gas",
  "Acc pois-utl gas NEC/NOS", "Acc poison-exhaust gas", "Acc pois-co/domestc fuel",
 "Acc pois-carbn monox NEC", "Acc pois-carbn monox NOS", "Acc poisn-nitrogen oxide",
  "Scndhnd tbcco smoke", "Acc poison-gas/vapor NEC", "Acc poison-gas/vapor NOS",
  "Acc cut/hem in surgery", "Acc cut/hem in infusion", "Acc cut/hem-perfusn NEC",
 "Acc cut/hem in injection", "Acc cut/hem w scope exam", "Acc cut/hem w catheteriz",
  "Acc cut/hem w heart cath", "Acc cut/hem w enema", "Acc cut in med care NEC",
  "Acc cut in med care NOS", "Post-surgical forgn body", "Postinfusion foreign bdy",
  "Postinjection forgn body", "Postendoscopy forgn body", "Postcatheter forgn body",
 "FB post-catheter removal", "Post-op foreign body NEC", "Post-op foreign body NOS",
  "Failure sterile surgery", "Failure sterile infusion", "Fail sterile catheter",
  "Fail sterile proced NEC", "Excess fluid in infusion", "Therap radiation overdos",
 "Inadv radiat exp-medical", "Dosag fail-shock therapy", "Wrng temp in applic/pack",
  "Nonadmin necess medicine", "Failure in dosage NEC", "Instrmnt fail in surgery",
  "Instrumnt fail-infusion", "Instrmnt fail-perfus NEC", "Instrmnt fail-catheteriz",
 "Instrmnt fail-proced NEC", "Instrmnt fail-proced NOS", "Contaminated transfusion",
  "Contaminated drug NEC", "Contamination NOS", "Mismatch blood-transfusn",
  "Wrong fluid in infusion", "Failure in suture", "Misplaced endotrach tube",
  "Fail introd/remove tube", "Proc-pt not sched surg", "Medical misadventure NEC",
  "Medical misadventure NOS", "Abn react-org transplant", "Abn react-artif implant",
  "Abn react-anastom/graft", "Abn react-external stoma", "Abn react-plast surg NEC",
  "Abn react-limb amputat", "Abn reac-organ rem NEC", "Abn react-surg proc NEC",
  "Abn react-surg proc NOS", "Abn react-cardiac cath", "Abn react-renal dialysis",
  "Abn react-radiotherapy", "Abn react-shock therapy", "Abn react-fluid aspirat",
  "Abn react-gastric sound", "Abn react-urinary cath", "Abn react-blood sampling",
  "Abn react-procedure NEC", "Abn react-procedure NOS", "Fall on escalator",
  "Fall on sidewalk curb", "Fall on stair/step NEC", "Fall from ladder",
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    "Fall from scaffolding", NA, "Diving accident", "Fall into well",
    "Fall into storm drain", "Fall into other hole", "Fall from playgrnd equip",
    "Fall from cliff", "Fall from chair", "Fall from wheelchair",
    "Fall from bed", "Fall from furniture NEC", "Fall from commode",
    "Fall-1 level to oth NEC", "Fall-nonmotor scooter", "Fall from roller skates",
    "Fall from skateboard", "Fall from skis", "Fall from snowboard",
    "Fall from slipping NEC", "Fall in sports", "Fall on level NEC/NOS",
    NA, "Fall striking sharp obj", "Fall striking sharp obj",
    "Fall striking object NEC", "Fall NEC", "Fall NOS", "Privat dwell fire-explos",
    "Priv dwel fire-pvc fumes", "Priv dwel fire-fumes NOS", "Priv dwel fire-burning",
    "Priv dwel fire-accid NEC", "Priv dwel fire-accid NOS", "Fire in bldg-explosion",
    "Fire in bldg-fumes NOS", "Fire in bldg-burning", "Fire in bldg-accid NEC",
    "Fire in bldg-accid NOS", NA, "Clothing fire-priv dwell",
    "Clothing fire-bldg NEC", "Clothing fire not in bld", "Clothing fire NEC",
    "Clothing fire NOS", NA, NA, NA, NA, "Burning bedclothes",
    "Fire accident NEC", NA, "Excessive heat: weather", "Excessive heat, man-made",
    "Excessive heat NOS", "Excessive cold: weather", "Excessive cold, man-made",
    "Excessive cold NEC", "Excessive cold NOS", "High altitude residence",
    "Air press chnge: aircrft", "Air press change: diving", "Air pressure change NEC",
    "Air pressure change NOS", NA, "Abandonment/lack of care",
    "Lack of food", "Exposure NEC", "Privation NOS", "Venomous snake bite",
    "Venomous spider bite", "Scorpion sting", "Hornet/wasp/bee sting",
    "Centipede bite", "Venomous arthropods NEC", "Venom sea animals/plants",
    "Poisoning by other plant", "Venomous bite/sting NEC", "Venomous bite/sting NOS",
    "Dog bite", "Rat bite", "Nonvenomous snake bite", "Animal bite NEC",
    "Nonvenom arthropod bite", "Animal bite NOS", "Inj NEC caused by animal",
    "Inj NOS caused by animal", NA, "Accident d/t hurricane",
    "Accident d/t tornado", "Accident d/t floods", "Acc d/t snow blizzard",
    "Accident d/t dust storm", "Accident d/t storm NEC", "Acc d/t storm/flood NOS",
    "Acc d/t earthquakes", "Acc d/t volcanic erupt", "Acc d/t avalanche",
    "Acc d/t dam collapse", "Acc d/t tidalwave NOS", "Acc d/t eruptions NEC",
    "Acc d/t eruptions NOS", "Water-skiing accident", "Skin/scuba diving acc",
    "Swimming accident NOS", "Swimming/diving acc NEC", "Drowning in bathtub",
    "Accidental drowning NEC", "Accidental drowning NOS", NA,
    NA, "Suffocat in bed/cradle", "Suffocation-plastic bag",
    "Suffocation-lack of air", "Cave-in NOS", "Suffocation NEC",
    "Suffocation NOS", NA, NA, NA, "Sports acc w/o sub fall",
    "Crowd w/o sub fall", "Run water w/o sub fall", "Furnit w/o sub fall",
    "Stat ob w/o sub fall NEC", "Sports acc w sub fall", "Crowd accidnt w sub fall",
    "Furniture acc w sub fall", "Stat obj w sub fall NEC", "Obj w-w/o sub fall NEC",
    NA, "Machine accid-agricult", "Machine accid-mining", "Lifting machine accident",
    "Metalworking machine acc", "Woodworking machine acc", "Prime mover machine acc",
    "Transmission machine acc", "Earth moving machine acc", "Machinery accident NEC",
    "Machinery accident NOS", "Acc-powered lawn mower", "Acc-power hand tool NEC",
    "Acc-power house applianc", "Knife/sword/dagger acc", "Accid-other hand tools",
    "Acc-hypodermic needle", "Acc-cutting instrum NEC", "Acc-cutting instrum NOS",
    "Boiler explosion", "Gas cylinder explosion", "Press vessel explos NEC",
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    "Press vessel explos NOS", "Handgun accident", "Shotgun accident",
    "Hunting rifle accident", "Military firearm accid", "Accident - air gun",
    "Accident-paintball gun", "Firearm accident NEC", "Firearm accident NOS",
    "Fireworks accident", "Blasting materials accid", "Explosive gases accident",
    "Explosives accident NEC", "Explosives accident NOS", "Acc-hot liquid & steam",
    "Accid-caustic substance", "Acc-hot tap water", "Hot substance accid NEC",
    "Hot substance accid NOS", "Domestic wiring accident", "Electr power generat acc",
   "Indust wiring/machin acc", "Electric current acc NEC", "Electric current acc NOS",
    "Radiofreq radiat exposur", "Infra-red appl rad exos", "Vis/ultraviol lght expos",
    "X-ray/gamma ray exposure", "Laser exposure", "Radioact isotope exposur",
    "Radiation exposure NEC", "Radiation exposure NOS", "Overxrt-sudn stren mvmt",
    "Overxrt-sudn stren mvmt", "Overxrt-prolng stc postn", "Excess physical exert",
    "Cumltv trma-repetv motn", "Cumltv trma-repetv impct", "Overexert reptv mvmt NEC",
    "Overexert reptv mvmt NOS", "Acc d/t weightless envir", "Exposure to noise",
    "Exposure to vibration", "Human bite - accidental", "Ext constriction-hair",
    "Ext constriction-obj NEC", "Accidnt-mech firearm/gun", "Accident NEC",
    "Accident NOS", "Late eff motor vehic acc", "Late eff transport acc",
    "Late eff acc poisoning", "Late eff accidental fall", "Late eff fire acc",
    "Late eff environment acc", "Late eff accident NEC", "Late eff accident NOS",
    "Adv eff penicillins", "Adv eff antifung antbiot", "Adv eff erythromycin",
    "Adv eff tetracycline", "Adv eff cephalosporin", "Adv eff antmycob antbiot",
    "Adv eff antineop antbiot", "Adv eff antibiotics NEC", "Adv eff antibiotic NOS",
    "Adv eff sulfonamides", "Adv eff quinoline", "Adv eff antimalarials",
    "Adv eff antprotazoal NEC", "Adv eff antiviral drugs", "Adv eff antimycobac NEC",
    "Adv eff antinfct NEC/NOS", "Adv eff corticosteroids", "Adv eff androgens",
    "Adv eff ovarian hormones", "Adv eff insulin/antidiab", "Adv eff ant pituitary",
    "Adv eff post pituitary", "Adv eff parathyroid", "Adv eff thyroid & deriv",
    "Adv eff antithyroid agnt", "Adv eff hormones NEC/NOS", "Adv eff anallrg/antemet",
    "Adv eff antineoplastic", "Adv eff vitamins NEC", "Oral bisphosphonates",
    "Adv eff systemic agt NOS", "Adv eff iron & compounds", "Adv eff anticoagulants",
    "Adv eff vitamin k", "Adv eff fibrinolysis agt", "Adv eff coagulants",
    "Adv eff gamma globulin", "Adv eff blood products", "Adv eff blood agent NEC",
    "Adv eff blood agent NOS", "Adv eff heroin", "Adv eff methadone",
    "Adv eff opiates", "Adv eff salicylates", "Adv eff arom analgsc NEC",
    "Adv eff pyrazole deriv", "Adv eff antirheumatics", "Adv eff non-narc analgsc",
    "Adv eff analgesics NEC", "Adv eff analgesic NOS", "Adv eff hydantoin deriv",
    "Adv eff succinimides", "Adv eff antconvl NEC/NOS", "Adv eff anti-parkinson",
    "Adv eff barbiturates", "Adv eff chloral hydrate", "Adv eff sedat/hypnot NEC",
    "Adv eff sedat/hypnot NOS", "Adv eff cns muscl depres", "Adv eff halothane",
    "Adv eff gas anesthet NEC", "Adv eff intraven anesth", "Adv eff gen anes NEC/NOS",
    "Adv eff topic/infil anes", "Adv eff nerve-block anes", "Adv eff spinal anesthet",
    "Adv eff loc anes NEC/NOS", "Adv eff antidepressants", "Adv eff phenothiaz tranq",
    "Adv eff butyrophen tranq", "Adv eff antipsychotc NEC", "Adv eff benzodiaz tranq",
    "Adv eff tranquilizer NEC", "Adv eff hallucinogens", "Adv eff psychostimulants",
    "Adv eff psychotropic NEC", "Adv eff psychotropic NOS", "Adv eff analeptics",
    "Adv eff opiat antagonist", "Adv eff cns stimulnt NEC", "Adv eff cholinergics",
    "Adv eff parasympatholytc", "Adv eff sympathomimetics", "Adv eff sympatholytics",
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    "Adv eff autonom agnt NOS", "Adv eff card rhyth regul", "Adv eff cardiotonics",
    "Adv eff antilipemics", "Adv eff ganglion-block", "Adv eff coronary vasodil",
    "Adv eff vasodilators NEC", "Adv eff antihyperten agt", "Adv eff capillary-act",
    "Adv eff cardiovasc NEC", "Adv eff antacids", "Adv eff irrit cathartic",
    "Adv eff emoll cathartics", "Adv eff cathartics NEC", "Adv eff digestants",
    "Adv eff antidiarrhea agt", "Adv eff GI agent NEC", "Adv eff purine diuretics",
    "Adv eff acetazolamide", "Adv eff saluretics", "Adv eff diuretics NEC",
    "Adv eff electrolyte agnt", "Adv eff mineral salt NEC", "Adv eff uric acid metab",
    "Adv eff oxytocic agents", "Adv eff smooth musc relx", "Adv eff skelet musc relx",
    "Adv eff musc agt NEC/NOS", "Adv eff antitussives", "Adv eff expectorants",
    "Adv eff anti-common cold", "Adv eff antiasthmatics", "Adv eff loc anti-infectv",
    "Adv eff local astringent", "Adv eff emollient/demulc", "Adv eff hair/scalp prep",
    "Adv eff eye anti-inf/drg", "Adv eff ent anti-inf/drg", "Adv eff skin agent NEC",
    "Adv eff skin agent NOS", "Adv eff lipotropic drugs", "Adv eff pharmaceut excip",
    "Adv eff medicinal NEC", "Adv eff medicinal NOS", "Adv eff plague vaccine",
    "Adv eff tetanus vaccine", "Adv eff bact vac NEC/NOS", "Adv eff mix bact vaccine",
    "Adv eff smallpox vaccine", "Adv eff rabies vaccine", "Adv eff polio vaccine",
    "Adv eff viral vacc NEC", "Adv eff biologic NEC/NOS", "Poison-analgesics",
    "Poison-barbiturates", "Poison-sedat/hypnotic", "Poison-psychotropic agt",
    "Poison-drug/medicin NEC", "Poison-drug/medicin NOS", "Poison-agricult agent",
    "Poison-corrosiv/caustic", "Poison-arsenic", "Poison-solid/liquid NEC",
    "Poison-exhaust gas", "Poison-co NEC", "Poison-gas/vapor NEC",
    "Poison-gas/vapor NOS", "Injury-hanging", "Injury-strang/suff NEC",
    "Injury-strang/suff NOS", NA, "Injury-handgun", "Injury-shotgun",
    "Injury-hunting rifle", "Injury-military firearm", "Injury-firearm NEC",
    "Injury-explosives", "Self inflict acc-air gun", "Injury-firearm/expl NOS",
    NA, "Injury-jump fm residence", "Injury-jump fm struc NEC",
    "Injury-jump fm natur sit", "Injury-jump NEC", "Injury-moving object",
    "Injury-burn, fire", "Injury-scald", "Injury-extreme cold",
    "Injury-electrocution", "Injury-motor veh crash", "Injury-caustic substance",
    "Injury-NEC", "Injury-NOS", NA, "Unarmed fight or brawl",
    "Rape", NA, "Assault-pois w medic agt", "Assault-pois w solid/liq",
    "Assault-pois w gas/vapor", NA, NA, "Assault-handgun", "Assault-shotgun",
    "Assault-hunting rifle", "Assault-military weapon", "Assault-firearm NEC",
    "Assault-antiperson bomb", "Assault-gasoline bomb", "Assault-explosive NEC",
    "Assault-explosive NOS", NA, "Abuse by fther/stpfth/bf",
    "Child abuse by pers NEC", "Abuse by mther/stpmth/gf", "Batter by spouse/partner",
    "Battering by child", "Battering by sibling", "Battering by grandparent",
    "Batter by other relative", "Batter by non-relative", "Child abuse NOS",
    "Assault-fire", "Asslt-push from hi place", "Assault-striking w obj",
    "Assault-hot liquid", "Assault-criminal neglect", "Asslt-transport vehicle",
    "Assault - air gun", "Human bite - assault", "Assault NEC",
    "Assault NOS", NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, "Terrorism,explosions",
    "Terrorism, fires", "Terrorism, firearms", "Undeterm pois-analgesics",
    "Undeterm pois-barbiturat", "Undet pois-sed/hypn NEC", "Undeterm pois-psychotrop",
    "Undet pois-med agnt NEC", "Undet pois-med agnt NOS", "Undet pois-corros/caust",
    "Undet pois-agricult agnt", "Undeter pois-sol/liq NEC", "Undeter pois-piped gas",
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    "Undeter pois-exhaust gas", "Undetermin poison-co NEC", "Undet pois-gas/vapor NOS",
    "Undetermin circ-hanging", "Undet circ-suffocate NEC", "Undet circ-suffocate NOS",
    NA, "Undetermin circ-handgun", "Undetermin circ-shotgun",
    "Undet circ-hunting rifle", "Undet circ-military arms", "Undeter circ-firearm NEC",
    "Undeterm circ-explosive", "Undetrmine accid-air gun", "Injury paintball gun NOS",
    NA, "Undet circ-fall residenc", "Undet fall structure NEC",
    "Undet fall natural site", "Undet circ-fall site NOS", "Undeterm circ-moving obj",
    "Undeterm circ-burn, fire", "Undeterm circ-scald", "Undeterm circ-extrm cold",
    "Undeterm circ-electrocut", "Undet circ-mot veh crash", "Undet circ-aircrft crash",
    "Undet circ-caustic subst", "Undetermin circumst NEC", "Undetermin circumst NOS",
    NA, "War injury:fire NEC", "War injury:bullet NEC", "War inj:munition fragmnt",
    "War inj:fragment IED NEC", "War inj:fragments NEC", "War inj:aerial bomb",
    "War inj:mortar", "War inj:IED NEC", "War inj:explosion NEC",
    "War inj:explosion NOS", "War inj:aircrft des-enmy", "War inj:hnd-hnd combat",
    "War inj:hnd-hnd combat", "War inj:con warfare NEC", "War inj:con warfare NOS",
    "War inj:dir nucl weapon", "War injury:gas/fum/chem", "Late effect, war injury",
    "Late effect, terrorism")


tab1$Description <- Descriptions

# checked descriptions by running multiple online searches
# from random sample, all appear correct

write.csv(tab1, "~/nis.00_11.ecode1InjCounts.csv")

# ecodes codes for severe injuries

inj.severe <- inj[inj$severe == 1, ]

injsvy.severe <- svydesign(id = ~HOSPID, strata = ~NIS_STRATUM,
    weights = ~DISCWT, nest = TRUE, data = inj.severe)

tab1 <- svytable(~ECODE1 + YEAR, injsvy.severe, round = T)
tab1 <- as.data.frame.matrix(tab1)

tab1$Ecode1 <- rownames(tab1)

tab1$Ecode1 <- rownames(tab1)  # create variable with ecodes (ended up as rownames from the survey tab
tab1 <- tab1[-c(1, nrow(tab1)), ]  # remove invalid and missing codes (first and last)

tab1$Ecode1[nchar(tab1$Ecode1) == 4] <- paste(tab1$Ecode1[nchar(tab1$Ecode1) ==
    4], "0", sep = "")  # convert ecodes to valid decimal format
tab1$Ecode1 <- paste(substring(tab1$Ecode1, 1, 4), ".", substring(tab1$Ecode1,
    5, 5), sep = "")

nrow(tab1)  # 918
```

```
# print them all out, invalid codes return 'character (0)'
for (i in 1:nrow(tab1)) {
    print(icd9ExplainDecimal(tab1$Ecode1[i], brief = T, doCondense = FALSE))
}

Descriptions <- c("Civilian activity-income", "Military activity",
    "Volunteer activity", "Externl cause status NEC", "Externl cause status NOS",
    "Walking,marching,hiking", "Running", "Swimming", "Springboard/platfrm dive",
    "Underwater dive/snorkel", "Water ski/wake boarding", "Surf,windsrf,boogie brd",
    "Water sliding", "Water/watercraft", "Ice Skating", "Ice hockey",
    "Ski,snow brd,sled,tobagn", "Ice and snow", "Mountain,rock/wall climb",
    "Climb,rappell,jump off", "Gymnastics", "Trampoline", "Roller skate,skateboard",
    "Horseback riding", "Golf", "Bike riding", "Individ sports,athletics",
    "Tackle football", "Amer flag/touch football", "Rugby", "Baseball",
    "Soccer", "Basketball", "Team sports,athletes", "Boxing",
    "Wrestling", "Martial arts", "Sports,athletics NEC", "Exercise mach(cardiorsp)",
    "Push-ups,pull-ups,sit-up", "Free weights", "Muscle strength exer NEC",
    "Personal bathing/shower", "Laundry", "Personal hygiene NEC",
    "Househld maintenance NEC", "Food prep & cleanup", "Grilling & smoking food",
    "Cooking & baking", "Cooking & grilling NEC", "Digging,shovel,rake",
    "Gardening/landscaping", "Building & construction", "Land maintain/cnstrt NEC",
    "External motion NEC", "Walking an animal", "Animal care NEC",
    "Spectator at event", "Rough housing/horseplay", "Activity NEC",
    NA, "RR collision NOS-employ", "RR coll NOS-passenger", "RR coll NOS-pedestrian",
    "RR coll NOS-ped cyclist", "RR coll NOS-person NEC", "RR coll NOS-person NOS",
    "RR coll w oth obj-employ", "RR coll w oth obj-pasngr", "RR coll w oth obj-pedest",
    "RR coll w oth obj-cycl", "RR col w oth obj-per NEC", "RR acc w derail-passeng",
    "RR acc w derail-pedest", "Fall on/from train-empl", "Fall from train-passengr",
    "Fall from train-pedest", "Fall from train-pers NEC", "Fall from train-pers NOS",
    "Hit by train-employee", "Hit by train-passenger", "Hit by train-pedestrian",
    "Hit by train-ped cyclist", "Hit by train-person NEC", "RR acc NEC-employee",
    "RR acc NEC-passenger", "RR acc NEC-pedestrian", "RR acc NEC-ped cyclist",
    "RR acc NEC-person NEC", "RR acc NEC-person NOS", "RR acc NOS-passenger",
    "RR acc NOS-pedestrian", "RR acc NOS-person NEC", "RR acc NOS-person NOS",
    "Mv-train coll-driver", "Mv-train coll-pasngr", "Mv-train coll-motorcycl",
    "Mv-train coll-mcycl psgr", "Mv-train coll-anim rid", "Mv-train coll-ped cycl",
    "Mv-train coll-pedest", "Mv-train coll-pers NEC", "Mv-train coll-pers NOS",
    "Reentrant mv coll-driver", "Reentrant mv coll-pasngr", "Reentrant coll-motcycl",
    "Reentrant coll-ped cycl", "Reentrant coll-pedest", "Reentrant coll-pers NEC",
    "Reentrant coll-pers NOS", "Mv collision NOS-driver", "Mv collision NOS-pasngr",
    "Mv collis NOS-motorcycl", "Mv coll NOS-mcycl psngr", "Mv collision NOS-st car",
    "Mv coll NOS-anim rid", "Mv coll NOS-ped cycl", "Mv collision NOS-pedest",
    "Mv collis NOS-pers NEC", "Mv collis NOS-pers NOS", "Mv-oth veh coll-driver",
    "Mv-oth veh coll-pasngr", "Mv-oth veh coll-motcycl", "Mv-oth veh coll-mcyc psg",
    "Mv-oth veh coll-st car", "Mv-oth veh coll-anim rid", "Mv-oth veh coll-ped cycl",
    "Mv-oth veh coll-pedest", "Mv-oth veh coll-pers NEC", "Mv-oth veh coll-pers NOS",
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"Mv coll w pedest-driver", "Mv coll w pedest-pasngr", "Mv coll w pedest-motcycl",
"Mv coll w ped-mcycl psgr", "Mv coll w pedest-st car", "Mv coll w ped-anim rid",
"Mv coll w ped-ped cycl", "Mv coll w pedest-pedest", "Mv coll w pedes-pers NEC",
"Mv coll w pedes-pers NOS", "Mv coll w oth obj-driver", "Mv coll w oth obj-pasngr",
"Mv coll w oth obj-mocycl", "Mv coll w obj-mcycl psgr", "Mv coll w obj-st car",
"Mv coll w obj-anim rider", "Mv coll w obj-ped cycl", "Mv coll w obj-pedest",
"Mv coll w obj-pers NEC", "Mv coll w obj-pers NOS", "Loss control mv acc-driv",
"Loss control mv acc-psgr", "Loss control mv-mocycl", "Loss control mv-mcyc psg",
"Loss cont mv acc-st car", "Loss cont mv-anim rider", "Loss control mv-ped cycl",
"Loss control mv-pedest", "Loss control mv-pers NEC", "Loss control mv-pers NOS",
"Mv acc board/alight-driv", "Mv acc board/alight-psgr", "Mv board/alight-motcycl",
"Mv brd/alight-mcycl psgr", "Mv acc brd/alight-st car", "Mv brd/alight-ped cycl",
"Mv brd/alight-pedestrian", "Mv board/alight-pers NEC", "Mv board/alight-pers NOS",
"Mv traff acc NEC-driver", "Mv traff acc NEC-pasngr", "Mv traff acc NEC-mocycl",
"Mv traff acc-mcycl psgr", "Mv traff acc NEC-st car", "Mv traff acc-ped cyc",
"Mv traff acc NEC-pedest", "Mv traff acc-pers NEC", "Mv traff acc-pers NOS",
"Traffic acc NOS-driver", "Traffic acc NOS-pasngr", "Traffic acc NOS-motcycl",
"Traff acc NOS-mcycl psgr", "Traffic acc NOS-st car", "Traff acc NOS-anim rider",
"Traffic acc NOS-ped cycl", "Traffic acc NOS-pedest", "Traffic acc NOS-pers NEC",
"Traffic acc NOS-pers NOS", "Snow veh acc-driver", "Snow veh acc-pasngr",
"Snow veh acc-motorcycl", "Snow veh acc-pedest", "Snow veh acc-pers NEC",
"Snow veh acc-pers NOS", "Oth off-road mv acc-driv", "Oth off-road mv acc-psgr",
"Oth off-road mv-mocycl", "Oth off-road mv-mcyc psg", "Oth off-road mv-st car",
"Oth off-road mv-anim rid", "Oth off-road mv-ped cycl", "Oth off-road mv-pedest",
"Oth off-road mv-pers NEC", "Oth off-road mv-pers NOS", "Oth coll w mov obj-driv",
"Oth coll w mov obj-psgr", "Oth coll mov obj-mocycl", "Oth coll mov obj-cyc psg",
"Oth coll mov obj-rider", "Oth coll mov obj-ped cyc", "Oth coll mov obj-pedest",
"Oth coll mov obj-per NEC", "Oth coll mov obj-per NOS", "Oth coll stndng obj-driv",
"Oth coll stndng obj-psgr", "Oth coll stnd obj-mocycl", "Oth coll stn obj-cyc psg",
"Oth coll stnd obj-rider", "Oth coll stn obj-ped cyc", "Oth coll stnd obj-pedest",
"Oth coll stn obj-per NEC", "Oth col-stnd-obj-per NOS", "N-traf board/alight-driv",
"N-traf board/alight-psgr", "N-traf brd/alight-mocycl", "N-traf brd/alit-mcyc psg",
"N-traf brd/alit-st car", "N-traf brd/alit-ped cycl", "N-traf brd/alit-pedest",
"N-traf brd/alit-pers NEC", "N-traf brd/alit-pers NOS", "Mv n-traff acc NEC-driv",
"Mv n-traff NEC/NOS-psgr", "Mv n-traf acc NEC-mocycl", "Mv n-traff NEC-mcyc psgr",
"Mv n-traff NEC-st car", "Mv n-traf NEC-anim rider", "Mv n-traff NEC-ped cycl",
"Mv n-traff NEC-pedest", "Mv n-traff NEC-pers NEC", "Mv n-traff NEC-pers NOS",
"Pedal cycle acc-pedest", "Ped cycl acc-ped cyclist", "Ped cycle acc-anim rider",
"Ped cycle acc-occ st car", "Ped cycle acc-pers NEC", "Ped cycle acc-pers NOS",
"Animal drawn veh-pedest", "Anim drawn veh-anim rid", "Animal drawn veh-occupan",
"Anim drawn veh-pers NEC", "Anim drawn veh-pers NOS", "Ridden animal acc-pedest",
"Ridden animal acc-rider", "Ridden animal acc-st car", "Ridden anim acc-pers NEC",
"Ridden anim acc-pers NOS", "Oth road veh acc-pedest", "Oth rd veh acc-st car",
"Oth rd veh acc-pers NEC", "Oth rd veh acc-pers NOS", "Boat acc w submers-unpow",
"Boat acc w submers-power", "Boat acc w submers-crew", "Boat acc w submers-psgr",
"Boat submers-water skier", "Boat submers-swimmer", "Boat submers-pers NEC",
"Boat acc inj NEC-unpower", "Boat acc inj NEC-power", "Boat acc inj NEC-crew",
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  "Boat acc inj NEC-passeng", "Boat acc inj NEC-skier", "Boat acc inj NEC-swim",
  "Boat acc inj NEC-docker", "Boat inj NEC-person NEC", "Boat inj NEC-person NOS",
  "Submers NEC-unpow boat", "Submers NEC-power boat", "Submers NEC-crew",
  "Submers NEC-passenger", "Submers NEC-water skier", "Submers NEC-swimmer",
  "Submers NEC-person NEC", "Submers NEC-person NOS", "W/craft stair fall-power",
 "Wtrcraft stair fall-crew", "Wtrcraft stair fall-psgr", "W/craft stair fall-skier",
  "W/crf stair fall-per NEC", "W/crf stair fall-per NOS", "W/craft fall NEC-unpow",
  "W/craft fall NEC-power", "Watercraft fall NEC-crew", "Wtrcraft fall NEC-pasngr",
  "W/craft fall NEC-skier", "W/craft fall NEC-swim", "Wtrcraft fall NEC-docker",
  "W/crft fall NEC-pers NEC", "W/crft fall NEC-pers NOS", "W/craft fall NOS-unpow",
  "W/craft fall NOS-power", "Wtrcraft fall NOS-crew", "Wtrcraft fall NOS-pasngr",
  "W/craft fall NOS-skier", "Wtrcraft fall NOS-docker", "W/crft fall NOS-pers NEC",
  "W/crft fall NOS-pers NOS", "Mach acc-occ power boat", "Machinery accident-crew",
  "Machinery acc-pasngr", "Machine accident-skier", "Machine accident-swim",
  "Machinery acc-pers NEC", "Explosion-occ power boat", "Watercraft explos-crew",
 "Watercraft explos-pasngr", "Watercraft explos-docker", "Watercraft expl-pers NEC",
 "Watercraft expl-pers NOS", "Watercraft acc NEC-unpow", "Watercraft acc NEC-power",
  "Watercraft acc NEC-crew", "Watercrft acc NEC-pasngr", "Watercraft acc NEC-skier",
 "Watrcrft acc NEC-swimmer", "Watercrft acc NEC-docker", "Wtrcrft acc NEC-pers NEC",
  "Wtrcrft acc NEC-pers NOS", "Tk off/land-milit craft", "Tk off/land-crew aircrft",
  "Tk off/land-psng aircrft", "Tk off/land-aircraft NEC", "Tk off/land-unp aircrft",
  "Tk off/land-parachutist", "Tk off/land-pers NEC", "Pow aircraft acc-spcrft",
  "Power aircraft acc-milit", "Power aircraft acc-crew", "Power aircraft acc-psngr",
 "Aircraf acc-occ comm NEC", "Oth powered aircraft acc", "Aircraft acc-parachutist",
 "Aircrft acc NOS-pers NEC", "Unpower aircraft acc-occ", "Unpow aircrf acc-chutist",
 "Unpow aircrf acc-gr crew", "Unpow aircrf acc-per NEC", "Fall-milit aircraft occp",
  "Fall-crew comm aircraft", "Fall-psng comm aircraft", "Fall-occup oth aircraft",
  "Fall-occ unpower aircraf", "Fall-parachutist", "Aircraft fall-person NEC",
  "Aircrft acc NEC-military", "Aircrft acc NEC-crew", "Aircrft acc NEC-pasngr",
  "Aircrft acc NEC-comm NEC", "Aircrft acc NEC-occp NEC", "Aircr acc NEC-unp aircr",
  "Aircrft acc-parachutist", "Aircrft acc NEC-grd crew", "Aircrft acc NEC-pers NEC",
  NA, NA, NA, "Accident in home", "Accident on farm", "Accident in mine/quarry",
  "Acc on industr premises", "Accid in recreation area", "Accid on street/highway",
  "Accident in public bldg", "Accid in resident instit", "Accident in place NEC",
  "Accident in place NOS", "Acc poison-heroin", "Acc poison-methadone",
  "Acc poison-opiates NEC", "Acc poison-salicylates", "Acc poison-arom analgesc",
  "Acc poison-analgesic NEC", NA, "Acc poison-sedatives NEC",
 "Acc poison-sedatives NOS", "Acc poisn-benzdiaz tranq", "Acc poison-antidepressnt",
 "Acc poison-hallucinogens", "Acc poisn-psychstimulant", "Acc poison-cns stimulant",
 "Acc poisn-anticonvulsant", "Acc poisn-cns depres NEC", "Acc poisn-local anesthet",
  "Acc poison-cns drug NOS", NA, "Acc poison-hormones", "Acc poisn-systemic agent",
  "Acc poison-blood agent", "Acc poisn-cardiovasc agt", "Acc poison-gi agent",
  "Acc poisn-skin/eent agnt", "Acc poisoning-drug NEC", "Acc poisoning-drug NOS",
 "Acc poisn-alcohol bevrag", "Acc poison-ethyl alcohol", "Acc poisn-methyl alcohol",
  "Acc poisn-isopropyl alc", "Acc pois-synth detergent", "Acc poison-polishes",
  "Acc poison-cleanser NEC", "Acc poison-disinfectants", "Acc poisn-petroleum fuel",
  "Acc poisn-solvents NEC", "Acc poison-herbicides", "Acc poison-acids",
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  "Acc poisn-caustic alkali", "Acc poison-caustic NEC", "Acc poison-caustic NOS",
  "Acc poison-meat", "Acc poison-fish NEC", "Acc poison-plants NEC",
  "Acc poison-food NEC", "Acc poisn-food/plant NOS", "Acc pois-solid/liq NEC",
  "Acc pois-solid/liq NOS", NA, "Acc pois-liq petrol gas",
  "Acc pois-utl gas NEC/NOS", "Acc poison-exhaust gas", "Acc pois-co/domestc fuel",
  "Acc pois-carbn monox NEC", "Acc pois-carbn monox NOS", "Scndhnd tbcco smoke",
  "Acc poison-gas/vapor NEC", "Acc poison-gas/vapor NOS", "Acc cut/hem in surgery",
  "Acc cut/hem in infusion", "Acc cut/hem in injection", "Acc cut/hem w scope exam",
  "Acc cut/hem w catheteriz", "Acc cut/hem w heart cath", "Acc cut in med care NEC",
  "Acc cut in med care NOS", "Post-surgical forgn body", "FB post-catheter removal",
  "Post-op foreign body NEC", "Failure sterile surgery", "Excess fluid in infusion",
 "Inadv radiat exp-medical", "Wrng temp in applic/pack", "Instrmnt fail in surgery",
  "Instrumnt fail-infusion", "Instrmnt fail-perfus NEC", "Instrmnt fail-proced NEC",
  "Contaminated transfusion", "Mismatch blood-transfusn", "Fail introd/remove tube",
  "Proc-pt not sched surg", "Medical misadventure NEC", "Medical misadventure NOS",
  "Abn react-org transplant", "Abn react-artif implant", "Abn react-anastom/graft",
  "Abn react-external stoma", "Abn react-plast surg NEC", "Abn react-limb amputat",
  "Abn reac-organ rem NEC", "Abn react-surg proc NEC", "Abn react-surg proc NOS",
  "Abn react-cardiac cath", "Abn react-renal dialysis", "Abn react-radiotherapy",
  "Abn react-fluid aspirat", "Abn react-urinary cath", "Abn react-blood sampling",
  "Abn react-procedure NEC", "Abn react-procedure NOS", "Fall on escalator",
  "Fall on sidewalk curb", "Fall on stair/step NEC", "Fall from ladder",
  "Fall from scaffolding", NA, "Diving accident", "Fall into well",
  "Fall into storm drain", "Fall into other hole", "Fall from playgrnd equip",
  "Fall from cliff", "Fall from chair", "Fall from wheelchair",
  "Fall from bed", "Fall from furniture NEC", "Fall from commode",
  "Fall-1 level to oth NEC", "Fall-nonmotor scooter", "Fall from roller skates",
  "Fall from skateboard", "Fall from skis", "Fall from snowboard",
  "Fall from slipping NEC", "Fall in sports", "Fall on level NEC/NOS",
 NA, "Fall striking sharp obj", "Fall striking sharp obj",
  "Fall striking object NEC", "Fall NEC", "Fall NOS", "Privat dwell fire-explos",
  "Priv dwel fire-pvc fumes", "Priv dwel fire-fumes NOS", "Priv dwel fire-burning",
  "Priv dwel fire-accid NEC", "Priv dwel fire-accid NOS", "Fire in bldg-explosion",
  "Fire in bldg-fumes NOS", "Fire in bldg-burning", "Fire in bldg-accid NEC",
  "Fire in bldg-accid NOS", NA, "Clothing fire-priv dwell",
  "Clothing fire-bldg NEC", "Clothing fire not in bld", "Clothing fire NEC",
  "Clothing fire NOS", NA, NA, NA, NA, "Burning bedclothes",
  "Fire accident NEC", NA, "Excessive heat: weather", "Excessive heat, man-made",
  "Excessive heat NOS", "Excessive cold: weather", "Excessive cold, man-made",
  "Excessive cold NEC", "Excessive cold NOS", "High altitude residence",
  "Air press chnge: aircrft", "Air press change: diving", "Air pressure change NEC",
  "Air pressure change NOS", "Abandonment/lack of care", "Exposure NEC",
  "Privation NOS", "Venomous snake bite", "Venomous spider bite",
  "Hornet/wasp/bee sting", "Venomous arthropods NEC", "Venom sea animals/plants",
  "Poisoning by other plant", "Venomous bite/sting NEC", "Dog bite",
  "Nonvenomous snake bite", "Animal bite NEC", "Nonvenom arthropod bite",
  "Animal bite NOS", "Inj NEC caused by animal", "Inj NOS caused by animal",
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    NA, "Accident d/t hurricane", "Accident d/t tornado", "Accident d/t floods",
    "Acc d/t snow blizzard", "Accident d/t storm NEC", "Acc d/t storm/flood NOS",
    "Acc d/t earthquakes", "Acc d/t volcanic erupt", "Acc d/t avalanche",
    "Acc d/t dam collapse", "Acc d/t eruptions NEC", "Water-skiing accident",
    "Skin/scuba diving acc", "Swimming accident NOS", "Swimming/diving acc NEC",
    "Drowning in bathtub", "Accidental drowning NEC", "Accidental drowning NOS",
    NA, NA, "Suffocat in bed/cradle", "Suffocation-plastic bag",
    "Suffocation-lack of air", "Cave-in NOS", "Suffocation NEC",
    "Suffocation NOS", NA, NA, NA, "Sports acc w/o sub fall",
    "Crowd w/o sub fall", "Run water w/o sub fall", "Furnit w/o sub fall",
    "Stat ob w/o sub fall NEC", "Sports acc w sub fall", "Crowd accidnt w sub fall",
    "Furniture acc w sub fall", "Stat obj w sub fall NEC", "Obj w-w/o sub fall NEC",
    NA, "Machine accid-agricult", "Machine accid-mining", "Lifting machine accident",
    "Metalworking machine acc", "Woodworking machine acc", "Prime mover machine acc",
    "Transmission machine acc", "Earth moving machine acc", "Machinery accident NEC",
    "Machinery accident NOS", "Acc-powered lawn mower", "Acc-power hand tool NEC",
    "Acc-power house applianc", "Knife/sword/dagger acc", "Accid-other hand tools",
    "Acc-hypodermic needle", "Acc-cutting instrum NEC", "Acc-cutting instrum NOS",
    "Boiler explosion", "Gas cylinder explosion", "Press vessel explos NEC",
    "Press vessel explos NOS", "Handgun accident", "Shotgun accident",
    "Hunting rifle accident", "Military firearm accid", "Accident - air gun",
    "Accident-paintball gun", "Firearm accident NEC", "Firearm accident NOS",
    "Fireworks accident", "Blasting materials accid", "Explosive gases accident",
    "Explosives accident NEC", "Explosives accident NOS", "Acc-hot liquid & steam",
    "Accid-caustic substance", "Acc-hot tap water", "Hot substance accid NEC",
    "Hot substance accid NOS", "Domestic wiring accident", "Electr power generat acc",
   "Indust wiring/machin acc", "Electric current acc NEC", "Electric current acc NOS",
    "Infra-red appl rad exos", "Vis/ultraviol lght expos", "X-ray/gamma ray exposure",
    "Laser exposure", "Radioact isotope exposur", "Radiation exposure NEC",
    "Radiation exposure NOS", "Overxrt-sudn stren mvmt", "Overxrt-sudn stren mvmt",
    "Overxrt-prolng stc postn", "Cumltv trma-repetv motn", "Cumltv trma-repetv impct",
   "Overexert reptv mvmt NEC", "Overexert reptv mvmt NOS", "Acc d/t weightless envir",
    "Exposure to vibration", "Human bite - accidental", "Ext constriction-obj NEC",
    "Accidnt-mech firearm/gun", "Accident NEC", "Accident NOS",
    "Late eff motor vehic acc", "Late eff transport acc", "Late eff acc poisoning",
    "Late eff accidental fall", "Late eff fire acc", "Late eff environment acc",
    "Late eff accident NEC", "Late eff accident NOS", "Adv eff penicillins",
    "Adv eff antifung antbiot", "Adv eff erythromycin", "Adv eff tetracycline",
    "Adv eff cephalosporin", "Adv eff antmycob antbiot", "Adv eff antineop antbiot",
    "Adv eff antibiotics NEC", "Adv eff antibiotic NOS", "Adv eff sulfonamides",
    "Adv eff quinoline", "Adv eff antimalarials", "Adv eff antprotazoal NEC",
    "Adv eff antiviral drugs", "Adv eff antinfct NEC/NOS", "Adv eff corticosteroids",
    "Adv eff androgens", "Adv eff ovarian hormones", "Adv eff insulin/antidiab",
    "Adv eff post pituitary", "Adv eff thyroid & deriv", "Adv eff antithyroid agnt",
    "Adv eff anallrg/antemet", "Adv eff antineoplastic", "Adv eff vitamins NEC",
    "Adv eff systemic agt NOS", "Adv eff iron & compounds", "Adv eff anticoagulants",
    "Adv eff coagulants", "Adv eff blood products", "Adv eff blood agent NEC",
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    "Adv eff methadone", "Adv eff opiates", "Adv eff salicylates",
    "Adv eff arom analgsc NEC", "Adv eff antirheumatics", "Adv eff non-narc analgsc",
    "Adv eff analgesics NEC", "Adv eff analgesic NOS", "Adv eff hydantoin deriv",
    "Adv eff succinimides", "Adv eff antconvl NEC/NOS", "Adv eff anti-parkinson",
    "Adv eff barbiturates", "Adv eff sedat/hypnot NEC", "Adv eff sedat/hypnot NOS",
    "Adv eff cns muscl depres", "Adv eff gas anesthet NEC", "Adv eff intraven anesth",
   "Adv eff gen anes NEC/NOS", "Adv eff topic/infil anes", "Adv eff nerve-block anes",
    "Adv eff spinal anesthet", "Adv eff loc anes NEC/NOS", "Adv eff antidepressants",
   "Adv eff phenothiaz tranq", "Adv eff butyrophen tranq", "Adv eff antipsychotc NEC",
    "Adv eff benzodiaz tranq", "Adv eff tranquilizer NEC", "Adv eff hallucinogens",
   "Adv eff psychostimulants", "Adv eff psychotropic NEC", "Adv eff psychotropic NOS",
    "Adv eff opiat antagonist", "Adv eff cns stimulnt NEC", "Adv eff cholinergics",
    "Adv eff parasympatholytc", "Adv eff sympathomimetics", "Adv eff sympatholytics",
    "Adv eff card rhyth regul", "Adv eff cardiotonics", "Adv eff antilipemics",
   "Adv eff coronary vasodil", "Adv eff vasodilators NEC", "Adv eff antihyperten agt",
    "Adv eff cardiovasc NEC", "Adv eff antacids", "Adv eff irrit cathartic",
    "Adv eff emoll cathartics", "Adv eff cathartics NEC", "Adv eff digestants",
    "Adv eff antidiarrhea agt", "Adv eff GI agent NEC", "Adv eff purine diuretics",
    "Adv eff saluretics", "Adv eff diuretics NEC", "Adv eff electrolyte agnt",
    "Adv eff uric acid metab", "Adv eff smooth musc relx", "Adv eff skelet musc relx",
    "Adv eff musc agt NEC/NOS", "Adv eff antitussives", "Adv eff expectorants",
    "Adv eff anti-common cold", "Adv eff antiasthmatics", "Adv eff loc anti-infectv",
    "Adv eff local astringent", "Adv eff hair/scalp prep", "Adv eff ent anti-inf/drg",
    "Adv eff lipotropic drugs", "Adv eff medicinal NEC", "Adv eff medicinal NOS",
    "Adv eff mix bact vaccine", "Adv eff smallpox vaccine", "Adv eff polio vaccine",
    "Poison-analgesics", "Poison-barbiturates", "Poison-sedat/hypnotic",
    "Poison-psychotropic agt", "Poison-drug/medicin NEC", "Poison-drug/medicin NOS",
    "Poison-agricult agent", "Poison-corrosiv/caustic", "Poison-solid/liquid NEC",
    "Poison-exhaust gas", "Poison-co NEC", "Poison-gas/vapor NEC",
    "Poison-gas/vapor NOS", "Injury-hanging", "Injury-strang/suff NEC",
    "Injury-strang/suff NOS", NA, "Injury-handgun", "Injury-shotgun",
    "Injury-hunting rifle", "Injury-military firearm", "Injury-firearm NEC",
    "Injury-explosives", "Self inflict acc-air gun", "Injury-firearm/expl NOS",
   NA, "Injury-jump fm residence", "Injury-jump fm struc NEC",
    "Injury-jump fm natur sit", "Injury-jump NEC", "Injury-moving object",
    "Injury-burn, fire", "Injury-scald", "Injury-extreme cold",
    "Injury-electrocution", "Injury-motor veh crash", "Injury-caustic substance",
    "Injury-NEC", "Injury-NOS", NA, "Unarmed fight or brawl",
    "Rape", NA, "Assault-pois w medic agt", "Assault-pois w solid/liq",
   NA, NA, "Assault-handgun", "Assault-shotgun", "Assault-hunting rifle",
    "Assault-military weapon", "Assault-firearm NEC", "Assault-antiperson bomb",
    "Assault-gasoline bomb", "Assault-explosive NEC", "Assault-explosive NOS",
   NA, "Abuse by fther/stpfth/bf", "Child abuse by pers NEC",
    "Abuse by mther/stpmth/gf", "Batter by spouse/partner", "Battering by child",
    "Battering by sibling", "Battering by grandparent", "Batter by other relative",
    "Batter by non-relative", "Child abuse NOS", "Assault-fire",
    "Asslt-push from hi place", "Assault-striking w obj", "Assault-hot liquid",
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    "Assault-criminal neglect", "Asslt-transport vehicle", "Assault - air gun",
    "Human bite - assault", "Assault NEC", "Assault NOS", NA,
    NA, NA, NA, NA, NA, NA, NA, NA, "Terrorism,explosions", "Terrorism, fires",
    "Undeterm pois-analgesics", "Undet pois-sed/hypn NEC", "Undeterm pois-psychotrop",
    "Undet pois-med agnt NEC", "Undet pois-med agnt NOS", "Undet pois-corros/caust",
    "Undet pois-agricult agnt", "Undeter pois-sol/liq NEC", "Undeter pois-exhaust gas",
    "Undetermin poison-co NEC", "Undet pois-gas/vapor NOS", "Undetermin circ-hanging",
    "Undet circ-suffocate NOS", NA, "Undetermin circ-handgun",
    "Undetermin circ-shotgun", "Undet circ-hunting rifle", "Undet circ-military arms",
    "Undeter circ-firearm NEC", "Undeterm circ-explosive", "Undetrmine accid-air gun",
    NA, "Undet circ-fall residenc", "Undet fall structure NEC",
    "Undet fall natural site", "Undet circ-fall site NOS", "Undeterm circ-moving obj",
    "Undeterm circ-burn, fire", "Undeterm circ-scald", "Undeterm circ-extrm cold",
    "Undeterm circ-electrocut", "Undet circ-mot veh crash", "Undet circ-aircrft crash",
    "Undet circ-caustic subst", "Undetermin circumst NEC", "Undetermin circumst NOS",
    NA, "War injury:bullet NEC", "War inj:fragment IED NEC",
    "War inj:fragments NEC", "War inj:aerial bomb", "War inj:explosion NEC",
    "War inj:hnd-hnd combat", "War inj:con warfare NOS", "War inj:dir nucl weapon",
    "Late effect, war injury")


tab1$Description <- Descriptions

write.csv(tab1, "~/nis.00_11.ecodeCountsSevere.csv")

# ecodes by age groups
tab1 <- svytable(~ECODE1 + ageGrp, injsvy, round = T)
tab1 <- as.data.frame.matrix(tab1)

tab1$Ecode1 <- rownames(tab1)

tab1$Ecode1 <- rownames(tab1)  # create variable with ecodes (ended up as rownames from the survey tab
tab1 <- tab1[-c(1, nrow(tab1)), ]  # remove invalid and missing codes (first and last)

tab1$Ecode1[nchar(tab1$Ecode1) == 4] <- paste(tab1$Ecode1[nchar(tab1$Ecode1) ==
    4], "0", sep = "")  # convert ecodes to valid decimal format
tab1$Ecode1 <- paste(substring(tab1$Ecode1, 1, 4), ".", substring(tab1$Ecode1,
    5, 5), sep = "")

nrow(tab1)  # 1081

# print them all out, invalid codes return 'character (0)'
for (i in 1:nrow(tab1)) {
    print(icd9ExplainDecimal(tab1$Ecode1[i], brief = T, doCondense = FALSE))
}

Descriptions <- c("Civilian activity-income", "Military activity",
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    "Volunteer activity", "Externl cause status NEC", "Externl cause status NOS",
    "Walking,marching,hiking", "Running", "Swimming", "Springboard/platfrm dive",
    "Underwater dive/snorkel", "Row,canoe,kayk,raft,tube", "Water ski/wake boarding",
    "Surf,windsrf,boogie brd", "Water sliding", "Water/watercraft",
    "Ice Skating", "Ice hockey", "Ski,snow brd,sled,tobagn",
    "Ice and snow", "Mountain,rock/wall climb", "BASE jumping",
    "Hang gliding", "Climb,rappell,jump off", "Dancing", "Yoga",
    "Gymnastics", "Trampoline", "Cheerleading", "Dancing,rhythm movements",
    "Roller skate,skateboard", "Horseback riding", "Golf", "Bowling",
    "Bike riding", "Non-running track/field", "Individ sports,athletics",
    "Tackle football", "Amer flag/touch football", "Rugby", "Baseball",
    "Lacrosse,field hockey", "Soccer", "Basketball", "Volleyball (beach,court)",
    "School recess,camp", "Team sports,athletes", "Boxing", "Wrestling",
    "Racquet/hand sports", "Frisbee", "Martial arts", "Sports,athletics NEC",
    "Exercise mach(cardiorsp)", "Aerobic,step exercise", "Cardioresp exercise NEC",
    "Muscle strength mach", "Push-ups,pull-ups,sit-up", "Free weights",
    "Pilates", "Muscle strength exer NEC", "Personal bathing/shower",
    "Laundry", "Vacuuming", "Floor mopping/cleaning", "Residential relocation",
    "Personal hygiene NEC", "Househld maintenance NEC", "Caregiving-lifting",
    "Caregiving NEC", "Food prep & cleanup", "Grilling & smoking food",
    "Cooking & baking", "Cooking & grilling NEC", "Digging,shovel,rake",
    "Gardening/landscaping", "Building & construction", "Land maintain/cnstrt NEC",
    "Roller coaster riding", "External motion NEC", "Walking an animal",
    "Animal care NEC", "Refereeing sports", "Spectator at event",
    "Rough housing/horseplay", "Activity NEC", NA, "RR collision NOS-employ",
    "RR coll NOS-passenger", "RR coll NOS-pedestrian", "RR coll NOS-ped cyclist",
    "RR coll NOS-person NEC", "RR coll NOS-person NOS", "RR coll w oth obj-employ",
    "RR coll w oth obj-pasngr", "RR coll w oth obj-pedest", "RR coll w oth obj-cycl",
    "RR col w oth obj-per NEC", "RR acc w derail-employee", "RR acc w derail-passeng",
    "RR acc w derail-pedest", "RR acc w explosion-empl", "Fall on/from train-empl",
    "Fall from train-passengr", "Fall from train-pedest", "Fall from train-pers NEC",
    "Fall from train-pers NOS", "Hit by train-employee", "Hit by train-passenger",
    "Hit by train-pedestrian", "Hit by train-ped cyclist", "Hit by train-person NEC",
    "Hit by train-person NOS", "RR acc NEC-employee", "RR acc NEC-passenger",
    "RR acc NEC-pedestrian", "RR acc NEC-ped cyclist", "RR acc NEC-person NEC",
    "RR acc NEC-person NOS", "RR accident NOS-employee", "RR acc NOS-passenger",
    "RR acc NOS-pedestrian", "RR acc NOS-person NEC", "RR acc NOS-person NOS",
    "Mv-train coll-driver", "Mv-train coll-pasngr", "Mv-train coll-motorcycl",
    "Mv-train coll-mcycl psgr", "Mv-train coll-anim rid", "Mv-train coll-ped cycl",
    "Mv-train coll-pedest", "Mv-train coll-pers NEC", "Mv-train coll-pers NOS",
    "Reentrant mv coll-driver", "Reentrant mv coll-pasngr", "Reentrant coll-motcycl",
    "Reentrant coll-mcyc psgr", "Reentrant coll-ped cycl", "Reentrant coll-pedest",
    "Reentrant coll-pers NEC", "Reentrant coll-pers NOS", "Mv collision NOS-driver",
    "Mv collision NOS-pasngr", "Mv collis NOS-motorcycl", "Mv coll NOS-mcycl psngr",
    "Mv collision NOS-st car", "Mv coll NOS-anim rid", "Mv coll NOS-ped cycl",
    "Mv collision NOS-pedest", "Mv collis NOS-pers NEC", "Mv collis NOS-pers NOS",
    "Mv-oth veh coll-driver", "Mv-oth veh coll-pasngr", "Mv-oth veh coll-motcycl",
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"Mv-oth veh coll-mcyc psg", "Mv-oth veh coll-st car", "Mv-oth veh coll-anim rid",
"Mv-oth veh coll-ped cycl", "Mv-oth veh coll-pedest", "Mv-oth veh coll-pers NEC",
"Mv-oth veh coll-pers NOS", "Mv coll w pedest-driver", "Mv coll w pedest-pasngr",
"Mv coll w pedest-motcycl", "Mv coll w ped-mcycl psgr", "Mv coll w pedest-st car",
"Mv coll w ped-anim rid", "Mv coll w ped-ped cycl", "Mv coll w pedest-pedest",
"Mv coll w pedes-pers NEC", "Mv coll w pedes-pers NOS", "Mv coll w oth obj-driver",
"Mv coll w oth obj-pasngr", "Mv coll w oth obj-mocycl", "Mv coll w obj-mcycl psgr",
"Mv coll w obj-st car", "Mv coll w obj-anim rider", "Mv coll w obj-ped cycl",
"Mv coll w obj-pedest", "Mv coll w obj-pers NEC", "Mv coll w obj-pers NOS",
"Loss control mv acc-driv", "Loss control mv acc-psgr", "Loss control mv-mocycl",
"Loss control mv-mcyc psg", "Loss cont mv acc-st car", "Loss cont mv-anim rider",
"Loss control mv-ped cycl", "Loss control mv-pedest", "Loss control mv-pers NEC",
"Loss control mv-pers NOS", "Mv acc board/alight-driv", "Mv acc board/alight-psgr",
"Mv board/alight-motcycl", "Mv brd/alight-mcycl psgr", "Mv acc brd/alight-st car",
"Mv brd/alight-anim rider", "Mv brd/alight-ped cycl", "Mv brd/alight-pedestrian",
"Mv board/alight-pers NEC", "Mv board/alight-pers NOS", "Mv traff acc NEC-driver",
"Mv traff acc NEC-pasngr", "Mv traff acc NEC-mocycl", "Mv traff acc-mcycl psgr",
"Mv traff acc NEC-st car", "Mv traff acc-anim rider", "Mv traff acc-ped cyc",
"Mv traff acc NEC-pedest", "Mv traff acc-pers NEC", "Mv traff acc-pers NOS",
"Traffic acc NOS-driver", "Traffic acc NOS-pasngr", "Traffic acc NOS-motcycl",
"Traff acc NOS-mcycl psgr", "Traffic acc NOS-st car", "Traff acc NOS-anim rider",
"Traffic acc NOS-ped cycl", "Traffic acc NOS-pedest", "Traffic acc NOS-pers NEC",
"Traffic acc NOS-pers NOS", "Snow veh acc-driver", "Snow veh acc-pasngr",
"Snow veh acc-motorcycl", "Snow veh acc-mcycl psgr", "Snow veh acc-pedest",
"Snow veh acc-pers NEC", "Snow veh acc-pers NOS", "Oth off-road mv acc-driv",
"Oth off-road mv acc-psgr", "Oth off-road mv-mocycl", "Oth off-road mv-mcyc psg",
"Oth off-road mv-st car", "Oth off-road mv-anim rid", "Oth off-road mv-ped cycl",
"Oth off-road mv-pedest", "Oth off-road mv-pers NEC", "Oth off-road mv-pers NOS",
"Oth coll w mov obj-driv", "Oth coll w mov obj-psgr", "Oth coll mov obj-mocycl",
"Oth coll mov obj-cyc psg", "Oth coll mov obj-rider", "Oth coll mov obj-ped cyc",
"Oth coll mov obj-pedest", "Oth coll mov obj-per NEC", "Oth coll mov obj-per NOS",
"Oth coll stndng obj-driv", "Oth coll stndng obj-psgr", "Oth coll stnd obj-mocycl",
"Oth coll stn obj-cyc psg", "Oth coll stnd obj-st car", "Oth coll stnd obj-rider",
"Oth coll stn obj-ped cyc", "Oth coll stnd obj-pedest", "Oth coll stn obj-per NEC",
"Oth col-stnd-obj-per NOS", "N-traf board/alight-driv", "N-traf board/alight-psgr",
"N-traf brd/alight-mocycl", "N-traf brd/alit-mcyc psg", "N-traf brd/alit-st car",
"N-traf brd/alit-anim rid", "N-traf brd/alit-ped cycl", "N-traf brd/alit-pedest",
"N-traf brd/alit-pers NEC", "N-traf brd/alit-pers NOS", "Mv n-traff acc NEC-driv",
"Mv n-traff NEC/NOS-psgr", "Mv n-traf acc NEC-mocycl", "Mv n-traff NEC-mcyc psgr",
"Mv n-traff NEC-st car", "Mv n-traf NEC-anim rider", "Mv n-traff NEC-ped cycl",
"Mv n-traff NEC-pedest", "Mv n-traff NEC-pers NEC", "Mv n-traff NEC-pers NOS",
"Pedal cycle acc-pedest", "Ped cycl acc-ped cyclist", "Ped cycle acc-anim rider",
"Ped cyc acc-occ anim veh", "Ped cycle acc-occ st car", "Ped cycle acc-pers NEC",
"Ped cycle acc-pers NOS", "Animal drawn veh-pedest", "Anim drawn veh-anim rid",
"Animal drawn veh-occupan", "Anim drawn veh-pers NEC", "Anim drawn veh-pers NOS",
"Ridden animal acc-pedest", "Ridden animal acc-rider", "Ridden animal acc-st car",
"Ridden anim acc-pers NEC", "Ridden anim acc-pers NOS", "Oth road veh acc-pedest",
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    "Oth rd veh acc-st car", "Oth rd veh acc-pers NEC", "Oth rd veh acc-pers NOS",
    "Boat acc w submers-unpow", "Boat acc w submers-power", "Boat acc w submers-crew",
    "Boat acc w submers-psgr", "Boat submers-water skier", "Boat submers-swimmer",
    "Boat submers-pers NEC", "Boat submers-pers NOS", "Boat acc inj NEC-unpower",
    "Boat acc inj NEC-power", "Boat acc inj NEC-crew", "Boat acc inj NEC-passeng",
    "Boat acc inj NEC-skier", "Boat acc inj NEC-swim", "Boat acc inj NEC-docker",
    "Boat inj NEC-person NEC", "Boat inj NEC-person NOS", "Submers NEC-unpow boat",
    "Submers NEC-power boat", "Submers NEC-crew", "Submers NEC-passenger",
    "Submers NEC-water skier", "Submers NEC-swimmer", "Submers NEC-docker",
    "Submers NEC-person NEC", "Submers NEC-person NOS", "W/craft stair fall-unpow",
   "W/craft stair fall-power", "Wtrcraft stair fall-crew", "Wtrcraft stair fall-psgr",
   "W/craft stair fall-skier", "W/crf stair fall-per NEC", "W/crf stair fall-per NOS",
    "W/craft fall NEC-unpow", "W/craft fall NEC-power", "Watercraft fall NEC-crew",
    "Wtrcraft fall NEC-pasngr", "W/craft fall NEC-skier", "W/craft fall NEC-swim",
   "Wtrcraft fall NEC-docker", "W/crft fall NEC-pers NEC", "W/crft fall NEC-pers NOS",
    "W/craft fall NOS-unpow", "W/craft fall NOS-power", "Wtrcraft fall NOS-crew",
    "Wtrcraft fall NOS-pasngr", "W/craft fall NOS-skier", "W/craft fall NOS-swim",
    "Wtrcraft fall NOS-docker", "W/crft fall NEC/NOS-mil", "W/crft fall NOS-pers NEC",
    "W/crft fall NOS-pers NOS", "Machine acc-unpow boat", "Mach acc-occ power boat",
    "Machinery accident-crew", "Machinery acc-pasngr", "Machine accident-skier",
    "Machine accident-swim", "Machinery acc-docker", "Machinery acc-pers NEC",
    "Machinery acc-pers NOS", "Explosion-occ unpow boat", "Explosion-occ power boat",
    "Watercraft explos-crew", "Watercraft explos-pasngr", "Watercraft explos-skier",
   "Watercraft explos-docker", "Watercraft expl-pers NEC", "Watercraft expl-pers NOS",
    "Watercraft acc NEC-unpow", "Watercraft acc NEC-power", "Watercraft acc NEC-crew",
   "Watercrft acc NEC-pasngr", "Watercraft acc NEC-skier", "Watrcrft acc NEC-swimmer",
   "Watercrft acc NEC-docker", "Wtrcrft acc NEC-pers NEC", "Wtrcrft acc NEC-pers NOS",
    "Tk off/land-spcrft", "Tk off/land-milit craft", "Tk off/land-crew aircrft",
    "Tk off/land-psng aircrft", "Tk off/land-aircraft NEC", "Tk off/land-unp aircrft",
    "Tk off/land-parachutist", "Tk off/land-ground crew", "Tk off/land-pers NEC",
    "Pow aircraft acc-spcrft", "Power aircraft acc-milit", "Power aircraft acc-crew",
   "Power aircraft acc-psngr", "Aircraf acc-occ comm NEC", "Oth powered aircraft acc",
   "Aircraft acc-parachutist", "Aircraft acc-ground crew", "Aircrft acc NOS-pers NEC",
   "Unpower aircraft acc-occ", "Unpow aircrf acc-chutist", "Unpow aircrf acc-gr crew",
    "Unpow aircrf acc-per NEC", "Fall-milit aircraft occp", "Fall-crew comm aircraft",
    "Fall-psng comm aircraft", "Fall-occ comm aircrf NEC", "Fall-occup oth aircraft",
    "Fall-occ unpower aircraf", "Fall-parachutist", "Aircrft fall-ground crew",
    "Aircraft fall-person NEC", "Aircrft acc NEC-spcrft", "Aircrft acc NEC-military",
    "Aircrft acc NEC-crew", "Aircrft acc NEC-pasngr", "Aircrft acc NEC-comm NEC",
    "Aircrft acc NEC-occp NEC", "Aircr acc NEC-unp aircr", "Aircrft acc-parachutist",
    "Aircrft acc NEC-grd crew", "Aircrft acc NEC-pers NEC", "Spacecraft acc-occupant",
    "Spacecraft acc-pers NEC", NA, NA, NA, "Accident in home",
    "Accident on farm", "Accident in mine/quarry", "Acc on industr premises",
    "Accid in recreation area", "Accid on street/highway", "Accident in public bldg",
    "Accid in resident instit", "Accident in place NEC", "Accident in place NOS",
    "Acc poison-heroin", "Acc poison-methadone", "Acc poison-opiates NEC",
    "Acc poison-salicylates", "Acc poison-arom analgesc", "Acc poison-nonnarc analg",
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  "Acc poison-analgesic NEC", "Acc poison-analgesic NOS", NA,
 "Acc poison-sedatives NEC", "Acc poison-sedatives NOS", "Acc pois-butyrphen tranq",
 "Acc poisn-benzdiaz tranq", "Acc poisn-tranquilzr NEC", "Acc poison-antidepressnt",
"Acc poison-hallucinogens", "Acc poisn-psychstimulant", "Acc poison-cns stimulant",
 "Acc poisn psychotrop NEC", "Acc poisn-anticonvulsant", "Acc poisn-cns depres NEC",
  "Acc poisn-local anesthet", "Acc poisn-anticholinerg", "Acc poison-cns drug NEC",
  "Acc poison-cns drug NOS", NA, NA, "Acc poison-hormones",
  "Acc poisn-systemic agent", "Acc poison-blood agent", "Acc poisn-cardiovasc agt",
  "Acc poison-gi agent", "Acc poisn-metabol agnt", "Acc poisn-muscl/resp agt",
  "Acc poisn-skin/eent agnt", "Acc poisoning-drug NEC", "Acc poisoning-drug NOS",
 "Acc poisn-alcohol bevrag", "Acc poison-ethyl alcohol", "Acc poisn-methyl alcohol",
  "Acc poisn-isopropyl alc", "Acc poison-alcohol NEC", "Acc poison-alcohol NOS",
  "Acc pois-synth detergent", "Acc poison-polishes", "Acc poison-cleanser NEC",
  "Acc poison-disinfectants", "Acc poison-lead paints", "Acc poison-paints NEC",
  "Acc poison-cleanser NOS", "Acc poisn-petroleum fuel", "Acc poisn-solvents NEC",
  "Acc poisn-solvent NOS", "Acc poison-herbicides", "Acc poison-fungicides",
  "Acc poison-rodenticides", "Acc pois-corrosiv aromat", "Acc poison-acids",
  "Acc poisn-caustic alkali", "Acc poison-caustic NEC", "Acc poison-caustic NOS",
  "Acc poison-meat", "Acc poison-shellfish", "Acc poison-fish NEC",
  "Acc poison-plants NEC", "Acc poison-food NEC", "Acc poisn-food/plant NOS",
  "Acc poisoning-lead", "Acc poisoning-mercury", "Acc poison-metals NEC",
  "Acc poison-glues", "Acc pois-solid/liq NEC", "Acc pois-solid/liq NOS",
 NA, "Acc pois-liq petrol gas", "Acc pois-utl gas NEC/NOS",
  "Acc poison-exhaust gas", "Acc pois-co/domestc fuel", "Acc pois-carbn monox NEC",
  "Acc pois-carbn monox NOS", "Acc poisn-nitrogen oxide", "Scndhnd tbcco smoke",
  "Acc poison-gas/vapor NEC", "Acc poison-gas/vapor NOS", "Acc cut/hem in surgery",
  "Acc cut/hem in infusion", "Acc cut/hem-perfusn NEC", "Acc cut/hem in injection",
 "Acc cut/hem w scope exam", "Acc cut/hem w catheteriz", "Acc cut/hem w heart cath",
  "Acc cut/hem w enema", "Acc cut in med care NEC", "Acc cut in med care NOS",
 "Post-surgical forgn body", "Postinfusion foreign bdy", "Postinjection forgn body",
  "Postendoscopy forgn body", "Postcatheter forgn body", "FB post-catheter removal",
  "Post-op foreign body NEC", "Post-op foreign body NOS", "Failure sterile surgery",
  "Failure sterile infusion", "Fail sterile catheter", "Fail sterile proced NEC",
 "Excess fluid in infusion", "Therap radiation overdos", "Inadv radiat exp-medical",
 "Dosag fail-shock therapy", "Wrng temp in applic/pack", "Nonadmin necess medicine",
  "Failure in dosage NEC", "Instrmnt fail in surgery", "Instrumnt fail-infusion",
 "Instrmnt fail-perfus NEC", "Instrmnt fail-catheteriz", "Instrmnt fail-proced NEC",
  "Instrmnt fail-proced NOS", "Contaminated transfusion", "Contaminated drug NEC",
  "Contamination NOS", "Mismatch blood-transfusn", "Wrong fluid in infusion",
  "Failure in suture", "Misplaced endotrach tube", "Fail introd/remove tube",
  "Proc-pt not sched surg", "Medical misadventure NEC", "Medical misadventure NOS",
  "Abn react-org transplant", "Abn react-artif implant", "Abn react-anastom/graft",
  "Abn react-external stoma", "Abn react-plast surg NEC", "Abn react-limb amputat",
  "Abn reac-organ rem NEC", "Abn react-surg proc NEC", "Abn react-surg proc NOS",
  "Abn react-cardiac cath", "Abn react-renal dialysis", "Abn react-radiotherapy",
  "Abn react-shock therapy", "Abn react-fluid aspirat", "Abn react-gastric sound",
  "Abn react-urinary cath", "Abn react-blood sampling", "Abn react-procedure NEC",
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    "Abn react-procedure NOS", "Fall on escalator", "Fall on sidewalk curb",
    "Fall on stair/step NEC", "Fall from ladder", "Fall from scaffolding",
    NA, "Diving accident", "Fall into well", "Fall into storm drain",
    "Fall into other hole", "Fall from playgrnd equip", "Fall from cliff",
    "Fall from chair", "Fall from wheelchair", "Fall from bed",
    "Fall from furniture NEC", "Fall from commode", "Fall-1 level to oth NEC",
    "Fall-nonmotor scooter", "Fall from roller skates", "Fall from skateboard",
    "Fall from skis", "Fall from snowboard", "Fall from slipping NEC",
    "Fall in sports", "Fall on level NEC/NOS", NA, "Fall striking sharp obj",
    "Fall striking sharp obj", "Fall striking object NEC", "Fall NEC",
    "Fall NOS", "Privat dwell fire-explos", "Priv dwel fire-pvc fumes",
    "Priv dwel fire-fumes NOS", "Priv dwel fire-burning", "Priv dwel fire-accid NEC",
    "Priv dwel fire-accid NOS", "Fire in bldg-explosion", "Fire in bldg-fumes NOS",
    "Fire in bldg-burning", "Fire in bldg-accid NEC", "Fire in bldg-accid NOS",
    NA, "Clothing fire-priv dwell", "Clothing fire-bldg NEC",
    "Clothing fire not in bld", "Clothing fire NEC", "Clothing fire NOS",
    NA, NA, NA, NA, "Burning bedclothes", "Fire accident NEC",
    NA, "Excessive heat: weather", "Excessive heat, man-made",
    "Excessive heat NOS", "Excessive cold: weather", "Excessive cold, man-made",
    "Excessive cold NEC", "Excessive cold NOS", "High altitude residence",
    "Air press chnge: aircrft", "Air press change: diving", "Air pressure change NEC",
    "Air pressure change NOS", NA, "Abandonment/lack of care",
    "Lack of food", "Exposure NEC", "Privation NOS", "Venomous snake bite",
    "Venomous spider bite", "Scorpion sting", "Hornet/wasp/bee sting",
    "Centipede bite", "Venomous arthropods NEC", "Venom sea animals/plants",
    "Poisoning by other plant", "Venomous bite/sting NEC", "Venomous bite/sting NOS",
    "Dog bite", "Rat bite", "Nonvenomous snake bite", "Animal bite NEC",
    "Nonvenom arthropod bite", "Animal bite NOS", "Inj NEC caused by animal",
    "Inj NOS caused by animal", NA, "Accident d/t hurricane",
    "Accident d/t tornado", "Accident d/t floods", "Acc d/t snow blizzard",
    "Accident d/t dust storm", "Accident d/t storm NEC", "Acc d/t storm/flood NOS",
    "Acc d/t earthquakes", "Acc d/t volcanic erupt", "Acc d/t avalanche",
    "Acc d/t dam collapse", "Acc d/t tidalwave NOS", "Acc d/t eruptions NEC",
    "Acc d/t eruptions NOS", "Water-skiing accident", "Skin/scuba diving acc",
    "Swimming accident NOS", "Swimming/diving acc NEC", "Drowning in bathtub",
    "Accidental drowning NEC", "Accidental drowning NOS", NA,
    NA, "Suffocat in bed/cradle", "Suffocation-plastic bag",
    "Suffocation-lack of air", "Cave-in NOS", "Suffocation NEC",
    "Suffocation NOS", NA, NA, NA, "Sports acc w/o sub fall",
    "Crowd w/o sub fall", "Run water w/o sub fall", "Furnit w/o sub fall",
    "Stat ob w/o sub fall NEC", "Sports acc w sub fall", "Crowd accidnt w sub fall",
    "Furniture acc w sub fall", "Stat obj w sub fall NEC", "Obj w-w/o sub fall NEC",
    NA, "Machine accid-agricult", "Machine accid-mining", "Lifting machine accident",
    "Metalworking machine acc", "Woodworking machine acc", "Prime mover machine acc",
    "Transmission machine acc", "Earth moving machine acc", "Machinery accident NEC",
    "Machinery accident NOS", "Acc-powered lawn mower", "Acc-power hand tool NEC",
    "Acc-power house applianc", "Knife/sword/dagger acc", "Accid-other hand tools",
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    "Acc-hypodermic needle", "Acc-cutting instrum NEC", "Acc-cutting instrum NOS",
    "Boiler explosion", "Gas cylinder explosion", "Press vessel explos NEC",
    "Press vessel explos NOS", "Handgun accident", "Shotgun accident",
    "Hunting rifle accident", "Military firearm accid", "Accident - air gun",
    "Accident-paintball gun", "Firearm accident NEC", "Firearm accident NOS",
    "Fireworks accident", "Blasting materials accid", "Explosive gases accident",
    "Explosives accident NEC", "Explosives accident NOS", "Acc-hot liquid & steam",
    "Accid-caustic substance", "Acc-hot tap water", "Hot substance accid NEC",
    "Hot substance accid NOS", "Domestic wiring accident", "Electr power generat acc",
   "Indust wiring/machin acc", "Electric current acc NEC", "Electric current acc NOS",
    "Radiofreq radiat exposur", "Infra-red appl rad exos", "Vis/ultraviol lght expos",
    "X-ray/gamma ray exposure", "Laser exposure", "Radioact isotope exposur",
    "Radiation exposure NEC", "Radiation exposure NOS", "Overxrt-sudn stren mvmt",
    "Overxrt-sudn stren mvmt", "Overxrt-prolng stc postn", "Excess physical exert",
    "Cumltv trma-repetv motn", "Cumltv trma-repetv impct", "Overexert reptv mvmt NEC",
    "Overexert reptv mvmt NOS", "Acc d/t weightless envir", "Exposure to noise",
    "Exposure to vibration", "Human bite - accidental", "Ext constriction-hair",
    "Ext constriction-obj NEC", "Accidnt-mech firearm/gun", "Accident NEC",
    "Accident NOS", "Late eff motor vehic acc", "Late eff transport acc",
    "Late eff acc poisoning", "Late eff accidental fall", "Late eff fire acc",
    "Late eff environment acc", "Late eff accident NEC", "Late eff accident NOS",
    "Adv eff penicillins", "Adv eff antifung antbiot", "Adv eff erythromycin",
    "Adv eff tetracycline", "Adv eff cephalosporin", "Adv eff antmycob antbiot",
    "Adv eff antineop antbiot", "Adv eff antibiotics NEC", "Adv eff antibiotic NOS",
    "Adv eff sulfonamides", "Adv eff quinoline", "Adv eff antimalarials",
    "Adv eff antprotazoal NEC", "Adv eff antiviral drugs", "Adv eff antimycobac NEC",
    "Adv eff antinfct NEC/NOS", "Adv eff corticosteroids", "Adv eff androgens",
    "Adv eff ovarian hormones", "Adv eff insulin/antidiab", "Adv eff ant pituitary",
    "Adv eff post pituitary", "Adv eff parathyroid", "Adv eff thyroid & deriv",
    "Adv eff antithyroid agnt", "Adv eff hormones NEC/NOS", "Adv eff anallrg/antemet",
    "Adv eff antineoplastic", "Adv eff vitamins NEC", "Oral bisphosphonates",
    "Adv eff systemic agt NOS", "Adv eff iron & compounds", "Adv eff anticoagulants",
    "Adv eff vitamin k", "Adv eff fibrinolysis agt", "Adv eff coagulants",
    "Adv eff gamma globulin", "Adv eff blood products", "Adv eff blood agent NEC",
    "Adv eff blood agent NOS", "Adv eff heroin", "Adv eff methadone",
    "Adv eff opiates", "Adv eff salicylates", "Adv eff arom analgsc NEC",
    "Adv eff pyrazole deriv", "Adv eff antirheumatics", "Adv eff non-narc analgsc",
    "Adv eff analgesics NEC", "Adv eff analgesic NOS", "Adv eff hydantoin deriv",
    "Adv eff succinimides", "Adv eff antconvl NEC/NOS", "Adv eff anti-parkinson",
    "Adv eff barbiturates", "Adv eff chloral hydrate", "Adv eff sedat/hypnot NEC",
    "Adv eff sedat/hypnot NOS", "Adv eff cns muscl depres", "Adv eff halothane",
    "Adv eff gas anesthet NEC", "Adv eff intraven anesth", "Adv eff gen anes NEC/NOS",
    "Adv eff topic/infil anes", "Adv eff nerve-block anes", "Adv eff spinal anesthet",
    "Adv eff loc anes NEC/NOS", "Adv eff antidepressants", "Adv eff phenothiaz tranq",
    "Adv eff butyrophen tranq", "Adv eff antipsychotc NEC", "Adv eff benzodiaz tranq",
    "Adv eff tranquilizer NEC", "Adv eff hallucinogens", "Adv eff psychostimulants",
    "Adv eff psychotropic NEC", "Adv eff psychotropic NOS", "Adv eff analeptics",
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    "Adv eff opiat antagonist", "Adv eff cns stimulnt NEC", "Adv eff cholinergics",
    "Adv eff parasympatholytc", "Adv eff sympathomimetics", "Adv eff sympatholytics",
    "Adv eff autonom agnt NOS", "Adv eff card rhyth regul", "Adv eff cardiotonics",
    "Adv eff antilipemics", "Adv eff ganglion-block", "Adv eff coronary vasodil",
    "Adv eff vasodilators NEC", "Adv eff antihyperten agt", "Adv eff capillary-act",
    "Adv eff cardiovasc NEC", "Adv eff antacids", "Adv eff irrit cathartic",
    "Adv eff emoll cathartics", "Adv eff cathartics NEC", "Adv eff digestants",
    "Adv eff antidiarrhea agt", "Adv eff GI agent NEC", "Adv eff purine diuretics",
    "Adv eff acetazolamide", "Adv eff saluretics", "Adv eff diuretics NEC",
    "Adv eff electrolyte agnt", "Adv eff mineral salt NEC", "Adv eff uric acid metab",
    "Adv eff oxytocic agents", "Adv eff smooth musc relx", "Adv eff skelet musc relx",
    "Adv eff musc agt NEC/NOS", "Adv eff antitussives", "Adv eff expectorants",
    "Adv eff anti-common cold", "Adv eff antiasthmatics", "Adv eff loc anti-infectv",
    "Adv eff local astringent", "Adv eff emollient/demulc", "Adv eff hair/scalp prep",
    "Adv eff eye anti-inf/drg", "Adv eff ent anti-inf/drg", "Adv eff skin agent NEC",
    "Adv eff skin agent NOS", "Adv eff lipotropic drugs", "Adv eff pharmaceut excip",
    "Adv eff medicinal NEC", "Adv eff medicinal NOS", "Adv eff plague vaccine",
    "Adv eff tetanus vaccine", "Adv eff mix bact vaccine", "Adv eff smallpox vaccine",
    "Adv eff rabies vaccine", "Adv eff polio vaccine", "Adv eff viral vacc NEC",
    "Adv eff biologic NEC/NOS", "Poison-analgesics", "Poison-barbiturates",
    "Poison-sedat/hypnotic", "Poison-psychotropic agt", "Poison-drug/medicin NEC",
    "Poison-drug/medicin NOS", "Poison-agricult agent", "Poison-corrosiv/caustic",
    "Poison-arsenic", "Poison-solid/liquid NEC", "Poison-exhaust gas",
    "Poison-co NEC", "Poison-gas/vapor NEC", "Poison-gas/vapor NOS",
    "Injury-hanging", "Injury-strang/suff NEC", "Injury-strang/suff NOS",
    NA, "Injury-handgun", "Injury-shotgun", "Injury-hunting rifle",
    "Injury-military firearm", "Injury-firearm NEC", "Injury-explosives",
    "Self inflict acc-air gun", "Injury-firearm/expl NOS", NA,
   "Injury-jump fm residence", "Injury-jump fm struc NEC", "Injury-jump fm natur sit",
    "Injury-jump NEC", "Injury-moving object", "Injury-burn, fire",
    "Injury-scald", "Injury-extreme cold", "Injury-electrocution",
    "Injury-motor veh crash", "Injury-caustic substance", "Injury-NEC",
   "Injury-NOS", NA, "Unarmed fight or brawl", "Rape", NA, "Assault-pois w medic agt",
    "Assault-pois w solid/liq", "Assault-pois w gas/vapor", NA,
    NA, "Assault-handgun", "Assault-shotgun", "Assault-hunting rifle",
    "Assault-military weapon", "Assault-firearm NEC", "Assault-antiperson bomb",
    "Assault-gasoline bomb", "Assault-explosive NEC", "Assault-explosive NOS",
    NA, "Abuse by fther/stpfth/bf", "Child abuse by pers NEC",
    "Abuse by mther/stpmth/gf", "Batter by spouse/partner", "Battering by child",
    "Battering by sibling", "Battering by grandparent", "Batter by other relative",
    "Batter by non-relative", "Child abuse NOS", "Assault-fire",
    "Asslt-push from hi place", "Assault-striking w obj", "Assault-hot liquid",
    "Assault-criminal neglect", "Asslt-transport vehicle", "Assault - air gun",
    "Human bite - assault", "Assault NEC", "Assault NOS", NA,
    NA, NA, NA, NA, NA, NA, NA, NA, NA, "Terrorism,explosions",
    "Terrorism, fires", "Terrorism, firearms", "Undeterm pois-analgesics",
    "Undeterm pois-barbiturat", "Undet pois-sed/hypn NEC", "Undeterm pois-psychotrop",
```

```
    "Undet pois-med agnt NEC", "Undet pois-med agnt NOS", "Undet pois-corros/caust",
    "Undet pois-agricult agnt", "Undeter pois-sol/liq NEC", "Undeter pois-piped gas",
    "Undeter pois-exhaust gas", "Undetermin poison-co NEC", "Undet pois-gas/vapor NOS",
    "Undetermin circ-hanging", "Undet circ-suffocate NEC", "Undet circ-suffocate NOS",
    NA, "Undetermin circ-handgun", "Undetermin circ-shotgun",
    "Undet circ-hunting rifle", "Undet circ-military arms", "Undeter circ-firearm NEC",
    "Undeterm circ-explosive", "Undetrmine accid-air gun", "Injury paintball gun NOS",
    NA, "Undet circ-fall residenc", "Undet fall structure NEC",
    "Undet fall natural site", "Undet circ-fall site NOS", "Undeterm circ-moving obj",
    "Undeterm circ-burn, fire", "Undeterm circ-scald", "Undeterm circ-extrm cold",
    "Undeterm circ-electrocut", "Undet circ-mot veh crash", "Undet circ-aircrft crash",
    "Undet circ-caustic subst", "Undetermin circumst NEC", "Undetermin circumst NOS",
    NA, "War injury:fire NEC", "War injury:bullet NEC", "War inj:munition fragmnt",
    "War inj:fragment IED NEC", "War inj:fragments NEC", "War inj:aerial bomb",
    "War inj:mortar", "War inj:IED NEC", "War inj:explosion NEC",
    "War inj:explosion NOS", "War inj:aircrft des-enmy", "War inj:hnd-hnd combat",
    "War inj:hnd-hnd combat", "War inj:con warfare NEC", "War inj:con warfare NOS",
    "War inj:dir nucl weapon", "War injury:gas/fum/chem", "Late effect, war injury",
    "Late effect, terrorism")

tab1$Description <- Descriptions


write.csv(tab1, "~/nis.00_11.ecodeCountsAgeGrp.csv")
```

4.7 creating procedure files

Used the HCUP Clinical Classification Software system included as native NIS variable to categorize the procedure codes. These are the "PRCCSn" variables. I have a csv files of labels that can be merged to the results of runs.

```
injsvy <- svydesign(id = ~HOSPID, strata = ~NIS_STRATUM, weights = ~DISCWT,
    nest = TRUE, data = inj)

ccsLabs <- read.csv("~/prlabel 2014.csv", header = F, stringsAsFactors = F,
    skip = 4)

str(ccsLabs)


# PRIMARY PROCS BY YEAR
tab1 <- svytable(~PRCCS1 + YEAR, injsvy, round = T)
tab1 <- as.data.frame.matrix(tab1)

tail(tab1)
```

```r
tab1$PRCCS1 <- rownames(tab1)  # create variable with procs (ended up as rownames from the survey table

allProcs <- merge(tab1, ccsLabs, all.x = T, by.x = "PRCCS1",
    by.y = "V1")

allProcs

write.csv(allProcs, "~/nis.00_11.allProcs.csv")


# procs codes for severe injuries

inj.severe <- inj[inj$severe == 1, ]

injsvy.severe <- svydesign(id = ~HOSPID, strata = ~NIS_STRATUM,
    weights = ~DISCWT, nest = TRUE, data = inj.severe)


tab1 <- svytable(~PRCCS1 + YEAR, injsvy.severe, round = T)
tab1 <- as.data.frame.matrix(tab1)

tab1$PRCCS1 <- rownames(tab1)


tab1$PRCCS1 <- rownames(tab1)  # create variable with procs (ended up as rownames from the survey table

severeProcs <- merge(tab1, ccsLabs, all.x = T, by.x = "PRCCS1",
    by.y = "V1")

write.csv(severeProcs, "~/nis.00_11.severeProcs.csv")

# procs by age groups
tab1 <- svytable(~PRCCS1 + ageGrp, injsvy, round = T)
tab1 <- as.data.frame.matrix(tab1)

tab1$PRCCS1 <- rownames(tab1)

tab1$PRCCS1 <- rownames(tab1)  # create variable with procs (ended up as rownames from the survey table


ageGrpProcs <- merge(tab1, ccsLabs, all.x = T, by.x = "PRCCS1",
    by.y = "V1")

write.csv(ageGrpProcs, "~/nis.00_11.ageGrpProcs.csv")
```

4.8 hospital file

Link the individual file to the hospital file to identify teaching hospitals and trauma centers by year and HCUP hospital identifier.

```
hosp2000 <- read.csv("~/HCUP Nationwide Inpatient Sample/2000/NIS_2000_ASCII/nis_2000_hospital.csv",
    header = T, stringsAsFactors = F)
hosp2001 <- read.csv("~/HCUP Nationwide Inpatient Sample/2001/NIS_2001_ASCII/nis_2001_hospital.csv",
    header = T, stringsAsFactors = F)
hosp2002 <- read.csv("~/HCUP Nationwide Inpatient Sample/2002/NIS_2002_ASCII/nis_2002_hospital.csv",
    header = T, stringsAsFactors = F)
hosp2003 <- read.csv("~/HCUP Nationwide Inpatient Sample/2003/NIS_2003_ASCII/nis_2003_hospital.csv",
    header = T, stringsAsFactors = F)
hosp2004 <- read.csv("~/HCUP Nationwide Inpatient Sample/2004/NIS_2004_ASCII/nis_2004_hospital.csv",
    header = T, stringsAsFactors = F)
hosp2005 <- read.csv("~/HCUP Nationwide Inpatient Sample/2005/NIS_2005_CORE_ASC/nis_2005_hospital.cs
    header = T, stringsAsFactors = F)
hosp2006 <- read.csv("~/HCUP Nationwide Inpatient Sample/2006/nis_2006_hospital.csv",
    header = T, stringsAsFactors = F)
hosp2007 <- read.csv("~/HCUP Nationwide Inpatient Sample/2007/nis_2007_hospital.csv",
    header = T, stringsAsFactors = F)
hosp2008 <- read.csv("~/HCUP Nationwide Inpatient Sample/2008/nis_2008_hospital.csv",
    header = T, stringsAsFactors = F)
hosp2009 <- read.csv("~/HCUP Nationwide Inpatient Sample/2009/nis_2009_hospital.csv",
    header = T, stringsAsFactors = F)
hosp2010 <- read.csv("~/HCUP Nationwide Inpatient Sample/2010/nis_2010_hospital.csv",
    header = T, stringsAsFactors = F)
hosp2011 <- read.csv("~/HCUP Nationwide Inpatient Sample/2011/nis_2011_hospital.csv",
    header = T, stringsAsFactors = F)


library(plyr)
hosp.00_11.inj <- rbind.fill(list(hosp2000, hosp2001, hosp2002,
    hosp2003, hosp2004, hosp2005, hosp2006, hosp2007, hosp2008,
    hosp2009, hosp2010, hosp2011), use.names = TRUE, fill = TRUE)

saveRDS(hosp.00_11.inj, "~/hosp.00_11.inj.rds")

inj2 <- merge(inj2, hosp.00_11.inj, by = c("HOSPID", "YEAR"),
    all.x = T)

sum(is.na(inj2$HOSP_TEACH))/nrow(inj2) * 100  # .6% missing teaching status
sum(is.na(inj2$HOSPZIP))/nrow(inj2) * 100  # 28.5% missing zip code

sum(is.na(inj2$HOSPNAME))/nrow(inj2) * 100  # 0% missing hospital name

# 2002 2007 2009 2010 1431 1448 1470 1621
```

```
names(inj2)[22] <- "DISCWT"
names(inj2)[52] <- "HOSPST"
names(inj2)[53] <- "HOSPSTCO"
names(inj2)[117] <- "DISCWTcharge"
names(inj2)[118] <- "NIS_STRATUM"

saveRDS(inj2, "~/nis.00_11.inj.rds")

bellevueHCUPinj <- inj2[inj2$HOSPNAME %in% "Bellevue Hospital Center",
    ]

saveRDS(bellevueHCUPinj, "~/bellevueHCUPinj.rds")
```

4.9 trauma centers

The data scraped from the http://www.amtrauma.org/?page=FindTraumaCenter website. Data are sent to the browser in JSON, or JavaScript Object Notation. Can get the raw Javascript objects here: https://fortress.maptive.com/ver4/data.php?operation=get_map_markers&data_id=13417&map_id=13398&bounds=3.621019,159.875214,75.871508,-33.484161&zoom=3&group=all&lat_col=12&lng_col=13&name_col=4&group_col=7&pie_chart=0&aggregation=-1. Copy and paste data on that site into a text document, append a .json extension, then use the RJSONIO package to read the data into R. This returns a 5 element list, one of which ("markers") contains a list of the 2040 hospitals, (names, trauma level, longitude and latitude). Convert this into a dataframe and save it for merging with the HCUP trauma dataset. [10]

Merging the trauma center data frame: (1) Use latitude and longitude variables from the trauma center data with ggmap::geocode() to get full information for each entry. (2) extract addresses from the resulting complex, nested list object, and extract out the state and zip codes from the addresses. (3) Identify all the non-duplicated hospital names in the HCUP trauma data set and create a data frame. (4) Merged the file of 2,040 trauma centers to the 3,706 HCUP injury hospitals using a combination of probabilistic matches on name and exact matches on zip codes [11] Results in 1,038 exact matches with an HCUP HOSPID variable and a ATS trauma designation. Merge this to the full HCUP injury file with the HOSPID variable.

```
library(RJSONIO)

trauma.dat <- fromJSON("~/traumaCenters.json")

str(trauma.dat$markers)
```

[10] Go back to the original file and search for invalid strings (preceded by back slashes...)

[11] The approach came from Tony Hirst and is described here http://www.r-bloggers.com/merging-data-sets-based-on-partially-matched-data-elements/

```r
centers <- data.frame(matrix(unlist(trauma.dat$markers), nrow = 2040,
    byrow = T), stringsAsFactors = FALSE)

names(centers) <- c("X1", "Latitude", "Longitude", "Hosp.Name",
    "Trauma.Status")

centers[centers$Hosp.Name == "Bellevue Hospital Center", ]

# get addresses from latitude and longitude

lat <- as.numeric(centers$Latitude)
lon <- as.numeric(centers$Longitude)

df <- data.frame(lat = lat, lon = lon)

library(ggmap)

res <- lapply(with(df, paste(lat, lon, sep = ",")), geocode,
    output = "more")
saveRDS(res, "~/traumaCentersGoogle.rds")  # takes long time to run so saving


# explore structure to figure out how to extract addresses
res2 <- sapply(res, "[[", "results")
res3 <- sapply(res2[1], "[[", 1)
res3[2]
sapply(sapply(res, "[[", "results")[1], "[[", 1)[2]

# run loop for each element

res[[1519]] <- NULL  # query 1519 returned error message as being over the query limit... have to corre
addresses <- rep(NA, 2039)  # NB one less than overall number of 2040 due to above

# formatted address
for (i in 1:length(addresses)) {
    addresses[i] <- sapply(sapply(res, "[[", "results")[i], "[[",
        1)[2]
    print(i)
}

addresses <- unlist(addresses)
addresses <- c(addresses[1:1518], NA, addresses[1519:2039])  # replace missing entry with NA

# add to the centers dataframe
centers$formatted.address <- addresses
```

```
# extract out state abbreviation and zip codes and add to the
# centers dataframe

library(stringr)
centers$zip.code <- str_sub(centers$formatted.address, -10, -6)
centers$state <- str_sub(centers$formatted.address, -13, -12)

# code submitted to google api:
# http://maps.googleapis.com/maps/api/geocode/json?latlng=34.1693089,-103.36317558&sensor=false
centers$formatted.address[1519] <- "42121 U.S. 70, Portales, NM 88130, USA"
centers$zip.code[1519] <- "88130"
centers$state[1519] <- "NM"

saveRDS(centers, "~/traumaCenters.rds")

centers <- readRDS("~/traumaCenters.rds")
# nis.hosp<-readRDS('~/hosp.00_11.inj.rds')
inj <- readRDS("~/nis.00_11.inj.rds")
sum(is.na(inj$HOSPNAME))/nrow(inj)  # 0
length(unique(inj$HOSPNAME))  #3,706

inj.hosp <- inj[!duplicated(inj$HOSPNAME), ]
nrow(inj.hosp)  # 3, 706

inj.hosp2 <- inj.hosp[, c("HOSPID", "HOSPNAME", "HOSPST", "HOSPSTCO",
    "HOSPZIP")]

head(inj.hosp2)
names(centers)

# from
# http://www.r-bloggers.com/merging-data-sets-based-on-partially-matched-data-elements/

signature = function(x) {
    sig = paste(sort(unlist(strsplit(tolower(x), " "))), collapse = "")
    return(sig)
}

partialMatch = function(x, y, levDist = 0.1) {
    xx = data.frame(sig = sapply(x, signature), row.names = NULL)
    yy = data.frame(sig = sapply(y, signature), row.names = NULL)
    xx$raw = x
    yy$raw = y
    xx = subset(xx, subset = (sig != ""))
    xy = merge(xx, yy, by = "sig", all = T)
    matched = subset(xy, subset = (!(is.na(raw.x)) & !(is.na(raw.y))))
    matched$pass = "Duplicate"
```

```
    todo = subset(xy, subset = (is.na(raw.y)), select = c(sig,
        raw.x))
    colnames(todo) = c("sig", "raw")
    todo$partials = as.character(sapply(todo$sig, agrep, yy$sig,
        max.distance = levDist, value = T))
    todo = merge(todo, yy, by.x = "partials", by.y = "sig")
    partial.matched = subset(todo, subset = (!(is.na(raw.x)) &
        !(is.na(raw.y))), select = c("sig", "raw.x", "raw.y"))
    partial.matched$pass = "Partial"
    matched = rbind(matched, partial.matched)
    un.matched = subset(todo, subset = (is.na(raw.x)), select = c("sig",
        "raw.x", "raw.y"))
    if (nrow(un.matched) > 0) {
        un.matched$pass = "Unmatched"
        matched = rbind(matched, un.matched)
    }
    matched = subset(matched, select = c("raw.x", "raw.y", "pass"))

    return(matched)
}

matches <- partialMatch(inj.hosp2$HOSPNAME, centers$Hosp.Name)

matches

# merge resulting 'signature' data frame with the data

a <- inj.hosp2
b <- centers
# Merge the original injury data set by hosptial name and
# signature keys
aa <- merge(a, matches, by.x = "HOSPNAME", by.y = "raw.x", all.x = T)
# Merge in the trauma center file
aa <- merge(aa, b, by.x = "raw.y", by.y = "Hosp.Name", all.x = T)
aa <- subset(aa, select = c("HOSPNAME", "HOSPID", "HOSPST", "HOSPZIP",
    "pass", "Latitude", "Longitude", "Trauma.Status", "formatted.address",
    "zip.code", "state"))

# select out exact matches
exactMatch <- aa[aa$pass == "Duplicate", ]  # 914 exact matches
sum(!is.na(exactMatch$HOSPID))  # 914
exactMatch <- exactMatch[1:914, ]  # remove unmatched NA's

# select out partial matches
partialMatch <- aa[aa$pass == "Partial", ]
# keep complete records with hospital id
sum(!is.na(partialMatch$HOSPID))  # 357
```

```
partialMatch <- partialMatch[!is.na(partialMatch$HOSPID), ]
# identify exact matches based on zip codes
partialMatch <- partialMatch[partialMatch$HOSPZIP == partialMatch$zip.code,
    ]
nrow(partialMatch)  # 157
# de-duplicate
partialMatch <- partialMatch[!duplicated(partialMatch$HOSPID),
    ]
nrow(partialMatch)  # 125

# combine exacts and de-duplicated correct partials
matched <- rbind(exactMatch, partialMatch)
nrow(matched)  # 1038

to.match <- matched[, c("HOSPID", "Latitude", "Longitude", "Trauma.Status",
    "formatted.address", "zip.code", "state")]

inj2 <- merge(x = as.data.frame(inj), y = to.match, by.x = "HOSPID",
    by.y = "HOSPID", all.x = T)

table(inj2$Trauma.Status)
# 0 1 2 3 4 5 19711 479559 443559 218511 162685 27653

sum(is.na(inj2$Trauma.Status))  # 2856910
sum(is.na(inj2$Trauma.Status))/nrow(inj2) * 100  # 67 %


inj2$Trauma.Status[is.na(inj2$Trauma.Status)] <- 99

table(inj2$Trauma.Status)

# 0 1 2 3 4 5 99 19711 479559 443559 218511 162685 27653
# 2856910


saveRDS(inj2, "~/nis.00_11.inj.rds")
```

5 about hcup

Healthcare Cost and Utilization Project (HCUP) is a group of inpatient and outpatient files created by AHRQ. Two main groups of products: state individual-level records and nationally representative samples based on those state files:

- SID (State Inpatient Data) - 97% of all discharges in the U.S. Essentially a census of hospital utilization. Includes admissions from ED. Released every month. Useful to

compare across states.

- NIS (National Inpatient Sample) - a 20% weighted sample of the SID; released yearly; more affordable; good for analysis at the national, regional and census area level; AHA hospital identifiers available prior to 2012
- KID (Kids Inpatient Database) - also derived from the SID; 10% sample of uncomplicated births plus 80% sample of all hospital discharges; released every three years
- SEDD (State Emergency Department Database) - yearly, per state (almost) census of ED Tx and release records; some states track revisits; useful for injury surveillance in or comparing states, correlations between ED use and events like disasters; combine with SID to get full picture of ED utilization
- NEDS - 20% weighted sample, national and regionally representative ED treat/release *and* admissions; variable for trauma center status; fewer variables than SEDD
- HCUP-Net - online query system, useful for initial analyses and to check your work
- HCUP Tools - supplemental files for trends and weights to allow for analysis across years

The NIS comes as an ascii fwf of about 8 million records (13GB). NEDS about 27 million records (75-100GB). Documentation is available at hcup-us.arhq.gov – Databases – NIS – database documentation. Useful to check your results against "Description of data elements in the NIS" – "Summary Statistics".

5.1 weighting NIS and NEDS

NIS is a stratified, single-cluster sample design (geographic area, urban/rural, ownership, teaching status, bed size). Weights must be applied to each entry to get national or regional estimates. The weight variable is "DISCWT" for discharge-level weights. Apply it to get estimates for all discharges in the US.

DISCWThas changed over time:

- 1998 - DISCWT_U (national estimates)
- 1998-1999 - DISCWT (national estimates)
- 2000 - DISCWTcharge (national estimates of total charge)
- 2000 - DISCWT (national estimates except those including total charge)
- 2001 and later - DISCWT (all national estimates)

The SAS code below demonstrates weighting to get estimates. Note, in addition to ICD9, HCUP uses clinical classification codes (CCS), which collapse icd9 codes into 126 clinically meaningful codes and their description; also available for procedure codes.

get percent of all discharges attributable to asthma:

```
Title1 "Count records with CCS=128 (asthma) from 2007 NIS File";
libname nis2007 "C:\NIS 2007\";
options obs = MAX PageSize=51 LineSize=146 ;

data asthma;
 set NIS2007.nis_2007_core (keep=KEY HOSPID DISCWT NIS_STRATUM DXCCS1);
 if dxccs1 eq 128 then asthma = 1;
 else asthma = 0;
run;

PROC SURVEYMEANS DATA=asthma SUM STD MEAN STDERR ;
 VAR asthma;
 CLUSTER hospid ;
 STRATA NIS_stratum ;
run;
```

get weighted estimate of number of asthma discharges:

```
Title1 "Produce national estimate of discharges with CCS=128 (asthma) from
2007 NIS File (weighted)";
libname nis2007 "C:\NIS 2007\";
options obs = MAX PageSize=51 LineSize=146 ;

data asthma;
 set NIS2007.nis_2007_core (keep=KEY HOSPID DISCWT NIS_STRATUM DXCCS1);
 if dxccs1 eq 128 then asthma = 1;
 else asthma = 0;
run;

PROC SURVEYMEANS DATA=asthma SUM STD MEAN STDERR ;
 VAR asthma;
 WEIGHT discwt;
 CLUSTER hospid ;
 STRATA NIS_stratum ;
run;
```

Verify your national estimates against H-CUPnet estimates. (Simpler check is multiply unweighted estimate by 5...)

Following code demonstrates how to get regional estimates:

```
Title1 "Produce regional estimates of discharges with CCS=128 (asthma) from
2007 NIS File (weighted)";
libname nis2007 "C:\NIS 2007\";
options obs = MAX PageSize=51 LineSize=146 ;

data asthma;
```

```
 set NIS2007.nis_2007_core (keep=KEY HOSPID DISCWT NIS_STRATUM DXCCS1);
 retain dischgs 1;
 region = substr(left(put(nis_stratum,8.)),1,1);
 if dxccs1 eq 128 then asthma = 1;
 else asthma = 0;
run;

PROC SURVEYMEANS DATA=asthma SUM STD MEAN STDERR ;
 VAR dischgs;
 WEIGHT discwt ;
 CLUSTER hospid ;
 STRATA NIS_stratum ;
 DOMAIN region * asthma ;
run;
```

If interested in hospital-level analyses, use "HOSPWT" for hospital-level weights, which returns estimates of all hospitals in the US. E.g. estimate number of teaching hospitals in the US:

```
Title1 "Count hospital records with HOSP_TEACH=1 from 2007 NIS HOSPITAL
File";
libname nis2007 "C:\NIS 2007\";
options obs = MAX PageSize=51 LineSize=146 ;

data TEACH1;
 set NIS2007.nis_2007_hospital (keep=HOSPID DISCWT NIS_STRATUM HOSP_TEACH);
 if hosp_teach = 1 then teach = 1;
 else teach = 0;
run;

PROC SURVEYMEANS DATA=TEACH1 SUM STD MEAN STDERR ;
 VAR teach;
 CLUSTER hospid ;
 STRATA NIS_stratum ;
run;
```

The NEDS data are weighted similarly to NIS. NEDS is stratified on geographic region, trauma center designation, urban/rural, teaching status, ownership.

5.2 multi-year analyses

There were major changes to NIS in 1998 (and KID in 2000) that cause discontinuity in the application of weights, changes to data elements in NIS prior to 2003, and some changes to data elements year to year based on state laws, and coding systems. Need to adjust for these changes for analyses over time, or combining data over years, e.g. for rare diseases.

- weights - 1997-1998 NIS, fewer hospitals (no more short-term rehab hospitals), similar changes to KID in 2000 (KID also started including children age 19 and 29)
- one-time revisions NIS prior to 2003
- other changes year to year based on variables collected by states, changes to billing codes etc...

Kinds of changes:

- rename - e.g. physician identifier, MDID_S changed to MDNUM1_S, same info, accounted for in the NIS Trends file
- recoded - e.g. gender, prior to 1997, called "SEX", after 1998 variable changed to "FEMALE"
- new - new data elements after 1998, e.g. secondary dx added to ccs (DXCCS1-15)

NIS (and KID) Trends files adjust for weighting changes and changes prior to 2003. Contain discharge weights for years prior to 1998 for NIS, and 2000 for KID. Designed to be merged with the original data files to adjust for 1998-2002 one-time changes:

- merge the trend files with the original NIS file
- use the NIS trend weights (DISCWT and HOSPWT) rather than DISCWT_U
- use NIS trend elements rather than those in original file prior to 2003

Yearly Changes:

- states adding/modifying data elements e.g. adding state postal codes, hiv dxs (can result in year to year under or over estimates...), check hcup availability data elements documents
- changes to standard billing forms, e.g. 2007 source of admission codes changed, old codes (ASOURCEUB92 and ASOURCE) begin to decline, new codes (PointOfOriginUB04 and PointOfOrigin_X) increase
- updates to coding systems - ICD9CM and DRGs are updated (some added, some retired) yearly, make sure your codes are consistent year to year;
  - see injuryCID9ConversionTable2013.pdf and multiple changes to Ecodes in 2009 document changesecodeChanges2009.pdf

5.3 about the R survey package

The variables required to set up a survey design object in the "survey" package are:

- ids - identifies the cluster. NIS prior to 2012 is a one-stage cluster. First sampled 20% of hospitals in the US, then 100% of discharges in those hospitals. "HOSPID" identifies the hospitals. Needed to remove the 2012 data because the survey design changed after that.

- nesting - needs to be set to TRUE to enforce nesting within strata
- strata - NIS_STRATUM, this variable appears to have a different name prior to 2000, so removed the 1998 and 1999 data.
- weights - DISCWT

Run some simple survey procedures to check the "survey" package codes are working appropriately. To keep consistent coding and weighting across years, will need to restrict the data to 2000 to 2011. Create a file for those years, and move the 98-12 file from Box to Pegasus external drive. Does not look like CSS will be very useful to identify injuries.

```
inj<-readRDS("~/nis.98_12.inj.rds")
inj<-inj[!is.na(inj$HOSPID),]
inj<-inj[!is.na(inj$NIS_STRATUM),]

?svydesign

injsvy <-
        svydesign(
             id = ~HOSPID ,  # cluster ids, NIS is single-stage cluster ("...20% stratified sample of h
                strata = ~NIS_STRATUM ,
                weights = ~DISCWT ,
                nest = TRUE,
                data = inj
        )


injsvy

# mean and stderr of two variables

svymean(~AGE + TOTCHG, injsvy, na.rm=T)

svytotal(~DXCCS1, injsvy)

svytable(~DXCCS1, injsvy)

tab1<-svytable(~DXCCS1+YEAR, injsvy, round=T)


library(xtable)
xtable(tab1)

saveRDS(inj, "~/nis.00_11.inj.rds")
```

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
225	18478.00	17049.00	17644.00	16903.00	17216.00	15789.00	16019.00	17051.00	15772.00	15585.00	15956.00	15537.00
226	314047.00	311281.00	305911.00	307698.00	304278.00	314345.00	304488.00	305163.00	313566.00	307558.00	303015.00	314139.00
227	11449.00	11130.00	12010.00	12838.00	15569.00	11741.00	13419.00	13226.00	12746.00	12737.00	16271.00	12813.00
228	46866.00	44920.00	50483.00	51870.00	54900.00	52601.00	54771.00	55229.00	52352.00	54791.00	65879.00	48575.00
229	142689.00	145819.00	151039.00	154699.00	162301.00	153719.00	157795.00	158024.00	155569.00	151879.00	163120.00	145376.00
230	262372.00	256540.00	262850.00	273436.00	284913.00	265398.00	265674.00	268047.00	262205.00	262071.00	280682.00	250604.00
231	150007.00	159971.00	164501.00	179565.00	187517.00	186067.00	201063.00	201344.00	215684.00	213779.00	236312.00	211121.00
232	61807.00	59703.00	55439.00	52118.00	53176.00	44859.00	41457.00	39449.00	36620.00	34760.00	32689.00	30522.00
233	137488.00	139949.00	152384.00	176847.00	186076.00	171263.00	191404.00	189783.00	194609.00	201470.00	245555.00	198143.00
234	92385.00	90222.00	100873.00	102642.00	119009.00	105700.00	115023.00	112912.00	105266.00	101677.00	123163.00	96082.00
235	44252.00	38844.00	45831.00	43018.00	43030.00	38194.00	40504.00	38322.00	35102.00	34924.00	41051.00	33262.00
236	52028.00	49577.00	52218.00	51480.00	57474.00	50277.00	50818.00	47967.00	42030.00	40812.00	46966.00	40866.00
237	30.00	20.00	12.00	14.00	5.00	5.00	5.00	10.00	25.00	0.00	5.00	0.00
238	178.00	165.00	121.00	206.00	160.00	200.00	122.00	163.00	133.00	170.00	195.00	209.00
239	53416.00	53181.00	54961.00	54707.00	58114.00	53159.00	53567.00	50595.00	47627.00	45749.00	47020.00	43348.00
240	26650.00	33348.00	28867.00	32952.00	32470.00	40742.00	28874.00	27835.00	30134.00	28973.00	43422.00	38910.00
241	64168.00	69652.00	69785.00	71182.00	78619.00	76875.00	79397.00	82272.00	90244.00	88602.00	92568.00	93833.00
242	123072.00	130780.00	136215.00	139549.00	151256.00	154709.00	169069.00	137062.00	144440.00	146104.00	152149.00	146906.00
243	23227.00	23067.00	23863.00	22918.00	24850.00	25234.00	24729.00	19378.00	18164.00	18691.00	20842.00	18192.00
244	80719.00	83489.00	84562.00	86101.00	86609.00	84299.00	85456.00	87554.00	85479.00	83345.00	91984.00	85026.00
253	7111.00	7044.00	7528.00	7202.00	7935.00	8089.00	9068.00	8674.00	8893.00	9302.00	9808.00	10364.00
660	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4551.00	4574.00	4568.00	5894.00	5278.00
661	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32748.00	38414.00	40436.00	46482.00	48589.00