Statistical Presentation

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```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(dplyr)
library(ggplot2)
library(readr)
```

```
library(labelled)
```

```
# Inspecting the dataset variabels
val_labels(HSE_2011)
```

```
## $hserial
## NULL
##
## $pserial
## NULL
##
## $HHSize
## NULL
##
## $tenureb
##                                                                    Refusal
##                                                                         -9
##                                                                 Don't Know
##                                                                         -8
##                                                       Schedule not applicable
##                                                                         -2
##                                                           Item not applicable
```

```
##                                                                                -1
##                                                                  Own it outright
##                                                                                1
##                                          Buying it with the help of a mortgage or loan
##                                                                                2
##                                        Pay part rent and part mortgage (shared ownership)
##                                                                                3
##                                                                         Rent it
##                                                                                4
## Live here rent free (including rent free in relatives/friends property; excluding squatting)
##                                                                                5
##                                                                       Squatting
##                                                                                6
##
## $Sex
##                 Refusal             Don't Know Schedule not applicable
##                      -9                     -8                      -2
##     Item not applicable                   Male                  Female
##                      -1                      1                       2
##
## $Age
## NULL
##
## $MonthAge
## NULL
##
## $WeekAge
## Over 2 years old
##              997
##
## $PersNo
## NULL
##
## $topqual3
##                     Refused                 Don't know
##                          -9                         -8
##       Refused/not obtained      Schedule not obtained
##                          -7                         -6
##    Schedule not applicable             Not applicable
##                          -2                         -1
##  NVQ4/NVQ5/Degree or equiv     Higher ed below degree
##                          1                          2
##     NVQ3/GCE A Level equiv     NVQ2/GCE O Level equiv
##                          3                          4
## NVQ1/CSE other grade equiv              Foreign/other
##                          5                          6
##           No qualification
##                          7
##
## $HRPID
##                 Refusal             Don't Know Schedule not applicable
##                      -9                     -8                      -2
##     Item not applicable                    HRP                  NotHRP
##                      -1                      1                       2
```

```
##
## $econact
##                      Refused                   Don't know
##                           -9                           -8
##        Refused/not obtained       Schedule not obtained
##                           -7                           -6
##     Schedule not applicable              Not applicable
##                           -2                           -1
##               In employment              ILO unemployed
##                            1                            2
##                      Retired Other economically inactive
##                            3                            4
##
## $nssec8
##                                        Refused
##                                             -9
##                                     Don't know
##                                             -8
##                             Refused/not obtained
##                                             -7
##                           Schedule not obtained
##                                             -6
##                         Schedule not applicable
##                                             -2
##                                  Not applicable
##                                             -1
## Higher managerial and professional occupations
##                                              1
##  Lower managerial and professional occupations
##                                              2
##                         Intermediate occupations
##                                              3
##        Small employers and own account workers
##                                              4
##    Lower supervisory and technical occupations
##                                              5
##                         Semi-routine occupations
##                                              6
##                              Routine occupations
##                                              7
##          Never worked and long term unemployed
##                                              8
##                                          Other
##                                             99
##
## $Origin
##                                             Refusal
##                                                  -9
##                                           Don't Know
##                                                  -8
##                                Schedule not applicable
##                                                  -2
##                                    Item not applicable
##                                                  -1
```

```
## White - English/Welsh/Scottish/Northern Irish/British
##                                                   1
##                                         White - Irish
##                                                   2
##                         White - Gypsy or Irish Traveller
##                                                   3
##                               Any other white background
##                                                   4
##                                White and Black Caribbean
##                                                   5
##                                  White and Black African
##                                                   6
##                                       White and Asian
##                                                   7
##              Any other mixed/multiple ethnic background
##                                                   8
##                                                 Indian
##                                                   9
##                                               Pakistani
##                                                  10
##                                             Bangladeshi
##                                                  11
##                                                 Chinese
##                                                  12
##                               Any other Asian background
##                                                  13
##                                               African
##                                                  14
##                                             Caribbean
##                                                  15
##            Any other Black/African/Caribbean background
##                                                  16
##                                                 Arab
##                                                  17
##                Any other ethnic group (please describe)
##                                                  18
##
## $totinc
##                  Refused              Don't know    Refused/not obtained
##                       -9                      -8                      -7
##   Schedule not obtained Schedule not applicable          Not applicable
##                       -6                      -2                      -1
##                    <£520            £520<£1,600          £1,600<£2,600
##                        1                       2                       3
##           £2,600<£3,600           £3,600<£5,200          £5,200<£7,800
##                        4                       5                       6
##          £7,800<£10,400         £10,400<£13,000         £13,000<£15,600
##                        7                       8                       9
##         £15,600<£18,200         £18,200<£20,800         £20,800<£23,400
##                       10                      11                      12
##         £23,400<£26,000         £26,000<£28,600         £28,600<£31,200
##                       13                      14                      15
##         £31,200<£33,800         £33,800<£36,400         £36,400<£41,600
##                       16                      17                      18
```

```
##         £41,600<£46,800         £46,800<£52,000         £52,000<£60,000
##                      19                      20                      21
##         £60,000<£70,000         £70,000<£80,000         £80,000<£90,000
##                      22                      23                      24
##        £90,000<£100,000       £100,000<£110,000       £110,000<£120,000
##                      25                      26                      27
##       £120,000<£130,000       £130,000<£140,000       £140,000<£150,000
##                      28                      29                      30
##             >=£150,000            Do not know                 Refused
##                      31                      96                      97
##
## $eqvinc
## Age of household member refused             Item not applicable
##                             -90                              -1
##
## $NurOutc
##                 Refused              Don't know    Refused/not obtained
##                      -9                      -8                      -7
##   Schedule not obtained Schedule not applicable          Not applicable
##                      -6                      -2                      -1
##
## $relto01
##                            Refused                          Don't know
##                                 -9                                  -8
##              Refused/not obtained              Schedule not obtained
##                                 -7                                  -6
##           Schedule not applicable                     Not applicable
##                                 -2                                  -1
##                       Husband/wife                  Partner/cohabitee
##                                  1                                   2
##               Natural son/daughter               Adopted son/daughter
##                                  3                                   4
##                       Foster child Stepson/daughter/child of partner
##                                  5                                   6
##                Son/daughter-in-law                     Natural parent
##                                  7                                   8
##                   Adoptive parent                      Foster parent
##                                  9                                  10
##       Stepparent/parent's partner                     Parent-in-law
##                                 11                                  12
##            Natural brother/sister                Half-brother/sister
##                                 13                                  14
##               Step brother/sister       Adopted half-brother/sister
##                                 15                                  16
##             Foster brother/sister             Brother/sister-in-law
##                                 17                                  18
##                          Grandchild                       Grandparent
##                                 19                                  20
##                    Other relative                 Other non-relative
##                                 21                                  22
##                               Self
##                                 96
##
## $relto02
```

```
##                           Refused                        Don't know
##                                -9                                -8
##              Refused/not obtained             Schedule not obtained
##                                -7                                -6
##           Schedule not applicable                    Not applicable
##                                -2                                -1
##                      Husband/wife                  Partner/cohabitee
##                                 1                                 2
##              Natural son/daughter              Adopted son/daughter
##                                 3                                 4
##                      Foster child Stepson/daughter/child of partner
##                                 5                                 6
##               Son/daughter-in-law                    Natural parent
##                                 7                                 8
##                   Adoptive parent                     Foster parent
##                                 9                                10
##       Stepparent/parent's partner                     Parent-in-law
##                                11                                12
##            Natural brother/sister               Half-brother/sister
##                                13                                14
##               Step brother/sister       Adopted half-brother/sister
##                                15                                16
##             Foster brother/sister             Brother/sister-in-law
##                                17                                18
##                         Grandchild                       Grandparent
##                                19                                20
##                    Other relative                  Other non-relative
##                                21                                22
##                              Self
##                                96
##
## $relto03
##                           Refused                        Don't know
##                                -9                                -8
##              Refused/not obtained             Schedule not obtained
##                                -7                                -6
##           Schedule not applicable                    Not applicable
##                                -2                                -1
##                      Husband/wife                  Partner/cohabitee
##                                 1                                 2
##              Natural son/daughter              Adopted son/daughter
##                                 3                                 4
##                      Foster child Stepson/daughter/child of partner
##                                 5                                 6
##               Son/daughter-in-law                    Natural parent
##                                 7                                 8
##                   Adoptive parent                     Foster parent
##                                 9                                10
##       Stepparent/parent's partner                     Parent-in-law
##                                11                                12
##            Natural brother/sister               Half-brother/sister
##                                13                                14
##               Step brother/sister       Adopted half-brother/sister
##                                15                                16
```

```
##             Foster brother/sister             Brother/sister-in-law
##                                17                                18
##                        Grandchild                       Grandparent
##                                19                                20
##                     Other relative                  Other non-relative
##                                21                                22
##                              Self
##                                96
##
## $relto04
##                             Refused                         Don't know
##                                -9                                -8
##              Refused/not obtained              Schedule not obtained
##                                -7                                -6
##           Schedule not applicable                     Not applicable
##                                -2                                -1
##                       Husband/wife                  Partner/cohabitee
##                                 1                                 2
##               Natural son/daughter               Adopted son/daughter
##                                 3                                 4
##                      Foster child Stepson/daughter/child of partner
##                                 5                                 6
##               Son/daughter-in-law                     Natural parent
##                                 7                                 8
##                   Adoptive parent                      Foster parent
##                                 9                                10
##       Stepparent/parent's partner                      Parent-in-law
##                                11                                12
##             Natural brother/sister                Half-brother/sister
##                                13                                14
##               Step brother/sister       Adopted half-brother/sister
##                                15                                16
##             Foster brother/sister             Brother/sister-in-law
##                                17                                18
##                        Grandchild                       Grandparent
##                                19                                20
##                     Other relative                  Other non-relative
##                                21                                22
##                              Self
##                                96
##
## $relto05
##                             Refused                         Don't know
##                                -9                                -8
##              Refused/not obtained              Schedule not obtained
##                                -7                                -6
##           Schedule not applicable                     Not applicable
##                                -2                                -1
##                       Husband/wife                  Partner/cohabitee
##                                 1                                 2
##               Natural son/daughter               Adopted son/daughter
##                                 3                                 4
##                      Foster child Stepson/daughter/child of partner
##                                 5                                 6
```

```
##               Son/daughter-in-law                    Natural parent
##                                 7                                 8
##                   Adoptive parent                     Foster parent
##                                 9                                10
##       Stepparent/parent's partner                     Parent-in-law
##                                11                                12
##            Natural brother/sister               Half-brother/sister
##                                13                                14
##               Step brother/sister       Adopted half-brother/sister
##                                15                                16
##             Foster brother/sister             Brother/sister-in-law
##                                17                                18
##                       Grandchild                       Grandparent
##                                19                                20
##                    Other relative                Other non-relative
##                                21                                22
##                              Self
##                                96
##
## $relto06
##                             Refused                        Don't know
##                                -9                                -8
##              Refused/not obtained              Schedule not obtained
##                                -7                                -6
##           Schedule not applicable                   Not applicable
##                                -2                                -1
##                      Husband/wife                  Partner/cohabitee
##                                 1                                 2
##              Natural son/daughter               Adopted son/daughter
##                                 3                                 4
##                     Foster child Stepson/daughter/child of partner
##                                 5                                 6
##               Son/daughter-in-law                    Natural parent
##                                 7                                 8
##                   Adoptive parent                     Foster parent
##                                 9                                10
##       Stepparent/parent's partner                     Parent-in-law
##                                11                                12
##            Natural brother/sister               Half-brother/sister
##                                13                                14
##               Step brother/sister       Adopted half-brother/sister
##                                15                                16
##             Foster brother/sister             Brother/sister-in-law
##                                17                                18
##                       Grandchild                       Grandparent
##                                19                                20
##                    Other relative                Other non-relative
##                                21                                22
##                              Self
##                                96
##
## $relto07
##                             Refused                        Don't know
##                                -9                                -8
```

```
##              Refused/not obtained             Schedule not obtained
##                                -7                                -6
##           Schedule not applicable                   Not applicable
##                                -2                                -1
##                      Husband/wife                  Partner/cohabitee
##                                 1                                 2
##              Natural son/daughter              Adopted son/daughter
##                                 3                                 4
##                      Foster child Stepson/daughter/child of partner
##                                 5                                 6
##               Son/daughter-in-law                     Natural parent
##                                 7                                 8
##                   Adoptive parent                      Foster parent
##                                 9                                10
##       Stepparent/parent's partner                      Parent-in-law
##                                11                                12
##            Natural brother/sister               Half-brother/sister
##                                13                                14
##               Step brother/sister       Adopted half-brother/sister
##                                15                                16
##             Foster brother/sister             Brother/sister-in-law
##                                17                                18
##                         Grandchild                       Grandparent
##                                19                                20
##                    Other relative                 Other non-relative
##                                21                                22
##                               Self
##                                96
##
## $relto08
##                             Refused                         Don't know
##                                -9                                -8
##              Refused/not obtained             Schedule not obtained
##                                -7                                -6
##           Schedule not applicable                   Not applicable
##                                -2                                -1
##                      Husband/wife                  Partner/cohabitee
##                                 1                                 2
##              Natural son/daughter              Adopted son/daughter
##                                 3                                 4
##                      Foster child Stepson/daughter/child of partner
##                                 5                                 6
##               Son/daughter-in-law                     Natural parent
##                                 7                                 8
##                   Adoptive parent                      Foster parent
##                                 9                                10
##       Stepparent/parent's partner                      Parent-in-law
##                                11                                12
##            Natural brother/sister               Half-brother/sister
##                                13                                14
##               Step brother/sister       Adopted half-brother/sister
##                                15                                16
##             Foster brother/sister             Brother/sister-in-law
##                                17                                18
```

```
##                         Grandchild                         Grandparent
##                                 19                                  20
##                      Other relative                  Other non-relative
##                                 21                                  22
##                               Self
##                                 96
##
## $relto09
##                             Refused                         Don't know
##                                  -9                                  -8
##                Refused/not obtained               Schedule not obtained
##                                  -7                                  -6
##             Schedule not applicable                     Not applicable
##                                  -2                                  -1
##                        Husband/wife                   Partner/cohabitee
##                                   1                                   2
##                Natural son/daughter                Adopted son/daughter
##                                   3                                   4
##                        Foster child Stepson/daughter/child of partner
##                                   5                                   6
##                 Son/daughter-in-law                     Natural parent
##                                   7                                   8
##                     Adoptive parent                      Foster parent
##                                   9                                  10
##         Stepparent/parent's partner                      Parent-in-law
##                                  11                                  12
##              Natural brother/sister                 Half-brother/sister
##                                  13                                  14
##                 Step brother/sister         Adopted half-brother/sister
##                                  15                                  16
##               Foster brother/sister               Brother/sister-in-law
##                                  17                                  18
##                         Grandchild                         Grandparent
##                                 19                                  20
##                      Other relative                  Other non-relative
##                                 21                                  22
##                               Self
##                                 96
##
## $Relto10
##                             Refused                         Don't know
##                                  -9                                  -8
##                Refused/not obtained               Schedule not obtained
##                                  -7                                  -6
##             Schedule not applicable                     Not applicable
##                                  -2                                  -1
##                        Husband/wife                   Partner/cohabitee
##                                   1                                   2
##                Natural son/daughter                Adopted son/daughter
##                                   3                                   4
##                        Foster child Stepson/daughter/child of partner
##                                   5                                   6
##                 Son/daughter-in-law                     Natural parent
##                                   7                                   8
```

```
##                   Adoptive parent                     Foster parent
##                                 9                                10
##       Stepparent/parent's partner                     Parent-in-law
##                                11                                12
##            Natural brother/sister               Half-brother/sister
##                                13                                14
##               Step brother/sister       Adopted half-brother/sister
##                                15                                16
##             Foster brother/sister             Brother/sister-in-law
##                                17                                18
##                         Grandchild                       Grandparent
##                                19                                20
##                    Other relative                 Other non-relative
##                                21                                22
##                              Self
##                                96
##
## $Relto11
##                             Refused                        Don't know
##                                -9                                -8
##              Refused/not obtained             Schedule not obtained
##                                -7                                -6
##           Schedule not applicable                    Not applicable
##                                -2                                -1
##                       Husband/wife                  Partner/cohabitee
##                                 1                                 2
##              Natural son/daughter               Adopted son/daughter
##                                 3                                 4
##                      Foster child Stepson/daughter/child of partner
##                                 5                                 6
##               Son/daughter-in-law                    Natural parent
##                                 7                                 8
##                   Adoptive parent                     Foster parent
##                                 9                                10
##       Stepparent/parent's partner                     Parent-in-law
##                                11                                12
##            Natural brother/sister               Half-brother/sister
##                                13                                14
##               Step brother/sister       Adopted half-brother/sister
##                                15                                16
##             Foster brother/sister             Brother/sister-in-law
##                                17                                18
##                         Grandchild                       Grandparent
##                                19                                20
##                    Other relative                 Other non-relative
##                                21                                22
##                              Self
##                                96
##
## $Relto12
##                             Refused                        Don't know
##                                -9                                -8
##              Refused/not obtained             Schedule not obtained
##                                -7                                -6
```

```
##           Schedule not applicable                    Not applicable
##                                -2                                -1
##                      Husband/wife                Partner/cohabitee
##                                 1                                 2
##              Natural son/daughter             Adopted son/daughter
##                                 3                                 4
##                      Foster child Stepson/daughter/child of partner
##                                 5                                 6
##               Son/daughter-in-law                    Natural parent
##                                 7                                 8
##                   Adoptive parent                     Foster parent
##                                 9                                10
##       Stepparent/parent's partner                     Parent-in-law
##                                11                                12
##            Natural brother/sister               Half-brother/sister
##                                13                                14
##               Step brother/sister       Adopted half-brother/sister
##                                15                                16
##             Foster brother/sister             Brother/sister-in-law
##                                17                                18
##                       Grandchild                       Grandparent
##                                19                                20
##                    Other relative                Other non-relative
##                                21                                22
##                              Self
##                                96
##
## $ReltoHRP
##                      Refusal                  Don't Know
##                           -9                          -8
##     Schedule not applicable         Item not applicable
##                           -2                          -1
##                     HusbWiOp           partner/cohabitee
##                            1                           2
##              natural SonDtr              adopted SonDtr
##                            3                           4
##                foster child stepSonDtr/child of partner
##                            5                           6
##               SonDtr-in-law              natural parent
##                            7                           8
##             adoptive parent               foster parent
##                            9                          10
## stepparent/parent s partner               parent-in-law
##                           11                          12
##              natural BroSis                 half-BroSis
##                           13                          14
##                 step-BroSis              adopted BroSis
##                           15                          16
##               foster BroSis               BroSis-in-law
##                           17                          18
##                  grandchild                 grandparent
##                           19                          20
##              other relative          other non-relative
##                           21                          22
```

```
##                         Self
##                           96
##
## $marstatc
##                                         Refused
##                                              -9
##                                      Don't know
##                                              -8
##                               Refused/not obtained
##                                              -7
##                             Schedule not obtained
##                                              -6
##                           Schedule not applicable
##                                              -2
##                                    Not applicable
##                                              -1
##                                          Single
##                                               1
##                                         Married
##                                               2
## Civil partnership including spontaneous answers
##                                               3
##                                       Separated
##                                               4
##                                        Divorced
##                                               5
##                                         Widowed
##                                               6
##                                      Cohabitees
##                                               7
##
## $SHA
## NULL
##
## $gor1
##                North East                North West Yorkshire and The Humber
##                         1                         2                         3
##            East Midlands             West Midlands           East of England
##                         4                         5                         6
##                    London                South East                South West
##                         7                         8                         9
##                     Wales                  Scotland
##                        10                        11
##
## $wt_int
## NULL
##
## $wt_nurse
## NULL
##
## $SayWgt
##                   Refusal               Don't Know Schedule not applicable
##                        -9                        -8                        -2
##     Item not applicable  About the right weight               Too heavy
```

```
##                      -1                       1                       2
##               Too light
##                       3
##
## $SayDiet
##                     Refusal                 Don't Know
##                          -9                         -8
##     Schedule not applicable         Item not applicable
##                          -2                         -1
##       Trying to lose weight       Trying to gain weight
##                           1                          2
## Not trying to change weight
##                           3
##
## $htval
##                  Refused              Don't know    Refused/not obtained
##                       -9                      -8                      -7
##   Schedule not obtained Schedule not applicable          Not applicable
##                       -6                      -2                      -1
##
## $wtval
##                  Refused              Don't know    Refused/not obtained
##                       -9                      -8                      -7
##   Schedule not obtained Schedule not applicable          Not applicable
##                       -6                      -2                      -1
##
## $bmival
##                  Refused              Don't know    Refused/not obtained
##                       -9                      -8                      -7
##   Schedule not obtained Schedule not applicable          Not applicable
##                       -6                      -2                      -1
##
## $whval
##                  Refused              Don't know    Refused/not obtained
##                       -9                      -8                      -7
##   Schedule not obtained Schedule not applicable          Not applicable
##                       -6                      -2                      -1
##
## $omdiaval
##                                          Refused
##                                               -9
##                                        Don't know
##                                               -8
## Refused, attempted but not obtained, not attempted
##                                               -7
##                              Schedule not obtained
##                                               -6
##                           Schedule not applicable
##                                               -2
##                                    Not applicable
##                                               -1
##
## $omsysval
##                                          Refused
```

```
##                                          -9
##                                  Don't know
##                                          -8
## Refused, attempted but not obtained, not attempted
##                                          -7
##                             Schedule not obtained
##                                          -6
##                           Schedule not applicable
##                                          -2
##                                  Not applicable
##                                          -1
##
## $dnnow
##             Refusal          Don't know Item not applicable                 Yes
##                  -9                  -8                  -1                   1
##                  No
##                   2
##
## $totalwu
## Refused/not answered           Don't know  Item not applicable
##                    -9                   -8                   -1
##
## $porfv
##                  Refused              Don't know    Refused/not obtained
##                       -9                      -8                      -7
##   Schedule not obtained Schedule not applicable          Not applicable
##                       -6                      -2                      -1
##
## $acutill
##                  Refused              Don't know    Refused/not obtained
##                       -9                      -8                      -7
##   Schedule not obtained Schedule not applicable          Not applicable
##                       -6                      -2                      -1
##       No acute sickness               1-3 days               4-6 days
##                        1                      2                       3
##               7-13 days          a full 2 weeks
##                        4                      5
##
## $IllsM1
##                                            Item not applicable
##                                                             -1
##                                              Cancer (neoplasm)
##                                                              1
##                                                       Diabetes
##                                                              2
##                                          Other endocrine/metabolic
##                                                              3
##                     Mental illness/anxiety/depression/nerves (nes)
##                                                              4
##                                                 Mental handicap
##                                                              5
##                                          Epilepsy/fits/convulsions
##                                                              6
##                                                 Migraine/headaches
```

```
##                                                          7
##                                Other problems of nervous system
##                                                          8
##                               Cataract/poor eye sight/blindness
##                                                          9
##                                           Other eye complaints
##                                                         10
##                                         Poor hearing/deafness
##                                                         11
##                                      Tinnitus/noises in the ear
##                                                         12
##          Menieres disease/ear complaints causing balance problems
##                                                         13
##                                           Other ear complaints
##                                                         14
##                 Stroke/cerebral haemorrhage/cerebral thrombosis
##                                                         15
##                                            Heart attack/angina
##                                                         16
##             Hypertension/high blood pressure/blood pressure (nes)
##                                                         17
##                                           Other heart problems
##                                                         18
##               Piles/haemorrhoids including Varicose Veins in anus
##                                                         19
##                     Varicose veins/phlebitis in lower extremities
##                                                         20
##                                      Other blood vessels/embolic
##                                                         21
##                                           Bronchitis/emphysema
##                                                         22
##                                                       Asthma
##                                                         23
##                                                     Hayfever
##                                                         24
##                                   Other respiratory complaints
##                                                         25
##              Stomach ulcer/ulcer (nes)/abdominal hernia/rupture
##                                                         26
##                                     Other digestive complaints
##                                                         27
##                                      Complaints of bowel/colon
##                                                         28
##                                Complaints of teeth/mouth/tongue
##                                                         29
##                                                Kidney complaints
##                                                         30
##                                         Urinary tract infection
##                                                         31
##                               Other bladder problems/incontinence
##                                                         32
##                                     Reproductive system disorders
##                                                         33
##                                    Arthritis/rheumatism/fibrositis
```

```
##                                                                  34
##                              Back problems/slipped disc/spine/neck
##                                                                  35
##                             Other problems of bones/joints/muscles
##                                                                  36
##                                  Infectious and parasitic disease
##                                                                  37
## Disorders of blood and blood forming organs and immunity disorders
##                                                                  38
##                                                       Skin complaints
##                                                                  39
##                                                     Other complaints
##                                                                  40
##                        Unclassifiable (no other codable complaint)
##                                                                  41
##                                     Complaint no longer present
##                                                                  42
##                                            Not Answered/Refusal
##                                                                  97
##                                         Not Answered / Refusal
##                                                                  99
##
## $IllsM2
##                                               Item not applicable
##                                                                  -1
##                                                 Cancer (neoplasm)
##                                                                   1
##                                                          Diabetes
##                                                                   2
##                                           Other endocrine/metabolic
##                                                                   3
##                      Mental illness/anxiety/depression/nerves (nes)
##                                                                   4
##                                                    Mental handicap
##                                                                   5
##                                          Epilepsy/fits/convulsions
##                                                                   6
##                                                  Migraine/headaches
##                                                                   7
##                                    Other problems of nervous system
##                                                                   8
##                                  Cataract/poor eye sight/blindness
##                                                                   9
##                                               Other eye complaints
##                                                                  10
##                                             Poor hearing/deafness
##                                                                  11
##                                        Tinnitus/noises in the ear
##                                                                  12
##           Menieres disease/ear complaints causing balance problems
##                                                                  13
##                                               Other ear complaints
##                                                                  14
##                     Stroke/cerebral haemorrhage/cerebral thrombosis
```

```
##                                                                15
##                                                 Heart attack/angina
##                                                                16
##              Hypertension/high blood pressure/blood pressure (nes)
##                                                                17
##                                               Other heart problems
##                                                                18
##                 Piles/haemorrhoids including Varicose Veins in anus
##                                                                19
##                       Varicose veins/phlebitis in lower extremities
##                                                                20
##                                        Other blood vessels/embolic
##                                                                21
##                                               Bronchitis/emphysema
##                                                                22
##                                                            Asthma
##                                                                23
##                                                          Hayfever
##                                                                24
##                                       Other respiratory complaints
##                                                                25
##                  Stomach ulcer/ulcer (nes)/abdominal hernia/rupture
##                                                                26
##                                         Other digestive complaints
##                                                                27
##                                          Complaints of bowel/colon
##                                                                28
##                                     Complaints of teeth/mouth/tongue
##                                                                29
##                                                  Kidney complaints
##                                                                30
##                                           Urinary tract infection
##                                                                31
##                                  Other bladder problems/incontinence
##                                                                32
##                                        Reproductive system disorders
##                                                                33
##                                     Arthritis/rheumatism/fibrositis
##                                                                34
##                                Back problems/slipped disc/spine/neck
##                                                                35
##                               Other problems of bones/joints/muscles
##                                                                36
##                                     Infectious and parasitic disease
##                                                                37
## Disorders of blood and blood forming organs and immunity disorders
##                                                                38
##                                                   Skin complaints
##                                                                39
##                                                 Other complaints
##                                                                40
##                         Unclassifiable (no other codable complaint)
##                                                                41
##                                       Complaint no longer present
```

```
##                                                    42
##                                     Not Answered/Refusal
##                                                    97
##                                   Not Answered / Refusal
##                                                    99
##
## $IllsM3
##                                       Item not applicable
##                                                    -1
##                                         Cancer (neoplasm)
##                                                     1
##                                                Diabetes
##                                                     2
##                                  Other endocrine/metabolic
##                                                     3
##                     Mental illness/anxiety/depression/nerves (nes)
##                                                     4
##                                             Mental handicap
##                                                     5
##                                   Epilepsy/fits/convulsions
##                                                     6
##                                          Migraine/headaches
##                                                     7
##                               Other problems of nervous system
##                                                     8
##                              Cataract/poor eye sight/blindness
##                                                     9
##                                          Other eye complaints
##                                                    10
##                                        Poor hearing/deafness
##                                                    11
##                                    Tinnitus/noises in the ear
##                                                    12
##           Menieres disease/ear complaints causing balance problems
##                                                    13
##                                         Other ear complaints
##                                                    14
##                  Stroke/cerebral haemorrhage/cerebral thrombosis
##                                                    15
##                                           Heart attack/angina
##                                                    16
##              Hypertension/high blood pressure/blood pressure (nes)
##                                                    17
##                                         Other heart problems
##                                                    18
##                Piles/haemorrhoids including Varicose Veins in anus
##                                                    19
##                      Varicose veins/phlebitis in lower extremities
##                                                    20
##                                   Other blood vessels/embolic
##                                                    21
##                                         Bronchitis/emphysema
##                                                    22
##                                                Asthma
```

```
##                                                                  23
##                                                            Hayfever
##                                                                  24
##                                        Other respiratory complaints
##                                                                  25
##                  Stomach ulcer/ulcer (nes)/abdominal hernia/rupture
##                                                                  26
##                                         Other digestive complaints
##                                                                  27
##                                          Complaints of bowel/colon
##                                                                  28
##                                      Complaints of teeth/mouth/tongue
##                                                                  29
##                                                   Kidney complaints
##                                                                  30
##                                           Urinary tract infection
##                                                                  31
##                                  Other bladder problems/incontinence
##                                                                  32
##                                        Reproductive system disorders
##                                                                  33
##                                     Arthritis/rheumatism/fibrositis
##                                                                  34
##                                Back problems/slipped disc/spine/neck
##                                                                  35
##                               Other problems of bones/joints/muscles
##                                                                  36
##                                     Infectious and parasitic disease
##                                                                  37
## Disorders of blood and blood forming organs and immunity disorders
##                                                                  38
##                                                     Skin complaints
##                                                                  39
##                                                   Other complaints
##                                                                  40
##                         Unclassifiable (no other codable complaint)
##                                                                  41
##                                       Complaint no longer present
##                                                                  42
##                                              Not Answered/Refusal
##                                                                  97
##                                            Not Answered / Refusal
##                                                                  99
##
## $IllsM4
##                                                  Item not applicable
##                                                                  -1
##                                                    Cancer (neoplasm)
##                                                                   1
##                                                            Diabetes
##                                                                   2
##                                         Other endocrine/metabolic
##                                                                   3
##                       Mental illness/anxiety/depression/nerves (nes)
```

```
##                                                                  4
##                                                       Mental handicap
##                                                                  5
##                                                Epilepsy/fits/convulsions
##                                                                  6
##                                                      Migraine/headaches
##                                                                  7
##                                    Other problems of nervous system
##                                                                  8
##                                   Cataract/poor eye sight/blindness
##                                                                  9
##                                                  Other eye complaints
##                                                                 10
##                                                 Poor hearing/deafness
##                                                                 11
##                                       Tinnitus/noises in the ear
##                                                                 12
##           Menieres disease/ear complaints causing balance problems
##                                                                 13
##                                                  Other ear complaints
##                                                                 14
##                  Stroke/cerebral haemorrhage/cerebral thrombosis
##                                                                 15
##                                                   Heart attack/angina
##                                                                 16
##             Hypertension/high blood pressure/blood pressure (nes)
##                                                                 17
##                                                  Other heart problems
##                                                                 18
##               Piles/haemorrhoids including Varicose Veins in anus
##                                                                 19
##                     Varicose veins/phlebitis in lower extremities
##                                                                 20
##                                       Other blood vessels/embolic
##                                                                 21
##                                              Bronchitis/emphysema
##                                                                 22
##                                                             Asthma
##                                                                 23
##                                                           Hayfever
##                                                                 24
##                                    Other respiratory complaints
##                                                                 25
##                Stomach ulcer/ulcer (nes)/abdominal hernia/rupture
##                                                                 26
##                                     Other digestive complaints
##                                                                 27
##                                      Complaints of bowel/colon
##                                                                 28
##                                   Complaints of teeth/mouth/tongue
##                                                                 29
##                                                Kidney complaints
##                                                                 30
##                                          Urinary tract infection
```

```
##                                                                 31
##                                 Other bladder problems/incontinence
##                                                                 32
##                                       Reproductive system disorders
##                                                                 33
##                                     Arthritis/rheumatism/fibrositis
##                                                                 34
##                                Back problems/slipped disc/spine/neck
##                                                                 35
##                               Other problems of bones/joints/muscles
##                                                                 36
##                                    Infectious and parasitic disease
##                                                                 37
## Disorders of blood and blood forming organs and immunity disorders
##                                                                 38
##                                                       Skin complaints
##                                                                 39
##                                                     Other complaints
##                                                                 40
##                          Unclassifiable (no other codable complaint)
##                                                                 41
##                                          Complaint no longer present
##                                                                 42
##                                                 Not Answered/Refusal
##                                                                 97
##                                               Not Answered / Refusal
##                                                                 99
##
## $IllsM5
##                                                   Item not applicable
##                                                                 -1
##                                                     Cancer (neoplasm)
##                                                                  1
##                                                            Diabetes
##                                                                  2
##                                                 Other endocrine/metabolic
##                                                                  3
##                        Mental illness/anxiety/depression/nerves (nes)
##                                                                  4
##                                                       Mental handicap
##                                                                  5
##                                                 Epilepsy/fits/convulsions
##                                                                  6
##                                                      Migraine/headaches
##                                                                  7
##                                     Other problems of nervous system
##                                                                  8
##                                    Cataract/poor eye sight/blindness
##                                                                  9
##                                                   Other eye complaints
##                                                                 10
##                                                 Poor hearing/deafness
##                                                                 11
##                                               Tinnitus/noises in the ear
```

```
##                                                              12
##           Menieres disease/ear complaints causing balance problems
##                                                              13
##                                                Other ear complaints
##                                                              14
##                     Stroke/cerebral haemorrhage/cerebral thrombosis
##                                                              15
##                                                 Heart attack/angina
##                                                              16
##              Hypertension/high blood pressure/blood pressure (nes)
##                                                              17
##                                                Other heart problems
##                                                              18
##                  Piles/haemorrhoids including Varicose Veins in anus
##                                                              19
##                        Varicose veins/phlebitis in lower extremities
##                                                              20
##                                       Other blood vessels/embolic
##                                                              21
##                                               Bronchitis/emphysema
##                                                              22
##                                                            Asthma
##                                                              23
##                                                          Hayfever
##                                                              24
##                                     Other respiratory complaints
##                                                              25
##                  Stomach ulcer/ulcer (nes)/abdominal hernia/rupture
##                                                              26
##                                       Other digestive complaints
##                                                              27
##                                        Complaints of bowel/colon
##                                                              28
##                                   Complaints of teeth/mouth/tongue
##                                                              29
##                                                 Kidney complaints
##                                                              30
##                                          Urinary tract infection
##                                                              31
##                                Other bladder problems/incontinence
##                                                              32
##                                     Reproductive system disorders
##                                                              33
##                                    Arthritis/rheumatism/fibrositis
##                                                              34
##                                Back problems/slipped disc/spine/neck
##                                                              35
##                               Other problems of bones/joints/muscles
##                                                              36
##                                    Infectious and parasitic disease
##                                                              37
## Disorders of blood and blood forming organs and immunity disorders
##                                                              38
##                                                   Skin complaints
```

```
##                                                          39
##                                                Other complaints
##                                                          40
##                          Unclassifiable (no other codable complaint)
##                                                          41
##                                       Complaint no longer present
##                                                          42
##                                             Not Answered/Refusal
##                                                          97
##                                           Not Answered / Refusal
##                                                          99
##
## $IllsM6
##                                               Item not applicable
##                                                          -1
##                                                 Cancer (neoplasm)
##                                                           1
##                                                        Diabetes
##                                                           2
##                                          Other endocrine/metabolic
##                                                           3
##                        Mental illness/anxiety/depression/nerves (nes)
##                                                           4
##                                                   Mental handicap
##                                                           5
##                                          Epilepsy/fits/convulsions
##                                                           6
##                                                 Migraine/headaches
##                                                           7
##                                    Other problems of nervous system
##                                                           8
##                                   Cataract/poor eye sight/blindness
##                                                           9
##                                                Other eye complaints
##                                                          10
##                                              Poor hearing/deafness
##                                                          11
##                                         Tinnitus/noises in the ear
##                                                          12
##           Menieres disease/ear complaints causing balance problems
##                                                          13
##                                                Other ear complaints
##                                                          14
##                       Stroke/cerebral haemorrhage/cerebral thrombosis
##                                                          15
##                                                 Heart attack/angina
##                                                          16
##              Hypertension/high blood pressure/blood pressure (nes)
##                                                          17
##                                                Other heart problems
##                                                          18
##                  Piles/haemorrhoids including Varicose Veins in anus
##                                                          19
##                        Varicose veins/phlebitis in lower extremities
```

```
##                                                    20
##                                 Other blood vessels/embolic
##                                                    21
##                                       Bronchitis/emphysema
##                                                    22
##                                                  Asthma
##                                                    23
##                                                Hayfever
##                                                    24
##                                 Other respiratory complaints
##                                                    25
##               Stomach ulcer/ulcer (nes)/abdominal hernia/rupture
##                                                    26
##                                   Other digestive complaints
##                                                    27
##                                    Complaints of bowel/colon
##                                                    28
##                                Complaints of teeth/mouth/tongue
##                                                    29
##                                             Kidney complaints
##                                                    30
##                                          Urinary tract infection
##                                                    31
##                              Other bladder problems/incontinence
##                                                    32
##                                   Reproductive system disorders
##                                                    33
##                                  Arthritis/rheumatism/fibrositis
##                                                    34
##                             Back problems/slipped disc/spine/neck
##                                                    35
##                            Other problems of bones/joints/muscles
##                                                    36
##                                 Infectious and parasitic disease
##                                                    37
## Disorders of blood and blood forming organs and immunity disorders
##                                                    38
##                                                Skin complaints
##                                                    39
##                                               Other complaints
##                                                    40
##                        Unclassifiable (no other codable complaint)
##                                                    41
##                                   Complaint no longer present
##                                                    42
##                                          Not Answered/Refusal
##                                                    97
##                                       Not Answered / Refusal
##                                                    99
##
## $limitill
##                  Refused              Don't know    Refused/not obtained
##                       -9                      -8                      -7
##   Schedule not obtained Schedule not applicable          Not applicable
```

```
##                      -6                      -2                      -1
##             Limiting LI         Non limiting LI                  No LI
##                       1                       2                       3
##
## $medcnj
##                                                 Refused
##                                                      -9
##                                               Don't know
##                                                      -8
##                                      Refused/not obtained
##                                                      -7
##                                    Schedule not obtained
##                                                      -6
##                                  Schedule not applicable
##                                                      -2
##                                           Not applicable
##                                                      -1
##                                                     Yes
##                                                       1
##                                                      No
##                                                       2
## Yes, but unable to code as name of drug(s) not available
##                                                       3
##
## $genhelf2
##      Dont know Very good/good           Fair   Bad/very bad
##             -8              1              2              3
##
## $cigst1
##                                 Refused                             Don't know
##                                      -9                                     -8
##                   Refused/not obtained                  Schedule not obtained
##                                      -7                                     -6
##               Schedule not applicable                          Not applicable
##                                      -2                                     -1
##        Never smoked cigarettes at all Used to smoke cigarettes occasionally
##                                       1                                     2
##    Used to smoke cigarettes regularly              Current cigarette smoker
##                                       3                                     4
##
## $cigst2
##                                   Refused                               Don't know
##                                        -9                                       -8
##                     Refused/not obtained                    Schedule not obtained
##                                        -7                                       -6
##                 Schedule not applicable                            Not applicable
##                                        -2                                       -1
##          Light smokers, under 10 a day Moderate smokers, 10 to under 20 a day
##                                         1                                       2
##        Heavy smokers, 20 or more a day         Don't know number smoked a day
##                                         3                                       4
##                               Non-smoker
##                                         5
```

#Check if has no missing entries on individual serial number variable

```
any(is.na(HSE_2011$pserial))
```

```
## [1] FALSE
```

Descriptive Statistics

a. How many people are included in the sample?

```
dim(HSE_2011)
```

```
## [1] 10617    58
```

b. What is the percentage of people who drink alcohol?

```
table(HSE_2011$dnnow)
```

```
##
##    1    2
## 6712 1822
```

```
alcohol_percent <- HSE_2011 %>%
  group_by(dnnow) %>%
  summarise(Percentage = n() / nrow(HSE_2011) * 100)

alcohol_percent
```

```
## # A tibble: 3 x 2
##   dnnow     Percentage
##   <dbl+lbl>      <dbl>
## 1  1 [Yes]        63.2
## 2  2 [No]         17.2
## 3 NA              19.6
```

```
table(HSE_2011$Sex)
```

```
##
##    1    2
## 4852 5765
```

c. What is the percentage of women in the sample?

```
#table(HSE_2011$Sex)
women <- HSE_2011 %>%
  group_by(Sex) %>%
  summarise(Percentage = n() / nrow(HSE_2011) * 100)
women
```

```
## # A tibble: 2 x 2
##   Sex        Percentage
##   <dbl+lbl>       <dbl>
## 1 1 [Male]         45.7
## 2 2 [Female]       54.3
```

d. What is the highest educational level?

```
table(HSE_2011$topqual3)
```

```
##
##    1    2    3    4    5    6    7
## 2008  948 1248 1803  395  127 2037
```

e. What is percentage of divorced and separated people?

```
val_labels(HSE_2011$marstatc)
```

```
##                                          Refused
##                                               -9
##                                       Don't know
##                                               -8
##                                Refused/not obtained
##                                               -7
##                              Schedule not obtained
##                                               -6
##                            Schedule not applicable
##                                               -2
##                                     Not applicable
##                                               -1
##                                           Single
##                                                1
##                                          Married
##                                                2
## Civil partnership including spontaneous answers
##                                                3
##                                        Separated
##                                                4
##                                         Divorced
##                                                5
```

```
##                                     Widowed
##                                           6
##                                   Cohabitees
##                                           7
```

```
table(HSE_2011$marstatc)
```

```
##
##    1    2    3    4    5    6    7
## 1613 4501    4  224  594  693  979
```

```
devorced_separated <- HSE_2011 %>%
  group_by(marstatc) %>%
  summarise(Percentage = n() / nrow(HSE_2011) * 100)

devorced_separated
```

```
## # A tibble: 8 x 2
##   marstatc                                                Percentage
##   <dbl+lbl>                                                    <dbl>
## 1  1 [Single]                                                 15.2
## 2  2 [Married]                                                42.4
## 3  3 [Civil partnership including spontaneous answers]         0.0377
## 4  4 [Separated]                                              2.11
## 5  5 [Divorced]                                               5.59
## 6  6 [Widowed]                                                6.53
## 7  7 [Cohabitees]                                             9.22
## 8 NA                                                         18.9
```

f. Find the mean, median, mode, minimum, maximum, range and standard deviation of household size, BMI and age at last birthday.

```
library(psych)
```

```
##
## Attaching package: 'psych'
```

```
## The following objects are masked from 'package:ggplot2':
##
##     %+%, alpha
```

```
library(tidyverse)
```

```
## -- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
## v forcats   1.0.0     v stringr   1.5.0
## v lubridate 1.9.2     v tibble    3.2.1
## v purrr     1.0.1     v tidyr     1.3.0
```

```
## -- Conflicts ---------------------------------------- tidyverse_conflicts() --
## x psych::%+%()    masks ggplot2::%+%()
## x psych::alpha()  masks ggplot2::alpha()
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

```
descriptives <- HSE_2011 %>% select(HHSize,bmival,Age) %>%   psych::describe(quant=c(.25,.75)) %>%
  as_tibble(rownames="rowname")  %>%
  print()
```

```
## # A tibble: 3 x 16
##   rowname  vars     n  mean    sd median trimmed   mad   min   max range    skew
##   <chr>   <int> <dbl> <dbl> <dbl>  <dbl>   <dbl> <dbl> <dbl> <dbl> <dbl>   <dbl>
## 1 HHSize      1 10617  2.85  1.37    3      2.75  1.48  1     10     9    0.834
## 2 bmival      2  8376 25.9   6.14   25.6   25.7   5.53  8.34  65.3  56.9  0.561
## 3 Age         3 10617 41.6  23.8    42     41.5  28.2   0    100   100   -0.0216
## # i 4 more variables: kurtosis <dbl>, se <dbl>, Q0.25 <dbl>, Q0.75 <dbl>
```

Removing negative entries for BMI

```
bmi <- HSE_2011 %>% filter(bmival > 0)
```

```
summary(bmi$bmival)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    8.34   21.93   25.59   25.92   29.39   65.28
```

BMI Range

```
range(bmi$bmival)
```

```
## <labelled<double>[2]>: (D) Valid BMI
## [1]  8.34011 65.27721
##
## Labels:
##  value                    label
##     -9                  Refused
##     -8               Don't know
##     -7    Refused/not obtained
##     -6   Schedule not obtained
##     -2 Schedule not applicable
##     -1          Not applicable
```

BMI Standard deviation

```
sd(bmi$bmival)
```

```
## [1] 6.138344
```

```
# Import the library
library(modeest)
```

```
## Registered S3 method overwritten by 'rmutil':
##   method         from
##   plot.residuals psych
```

```
# Compute the mode value
mode_house_size =  mfv(HSE_2011$HHSize,HSE_2011$Age,HSE_2011$bmival)
mode_age =  mfv(HSE_2011$Age)
mode_bmi =  mfv(HSE_2011$bmival)
print(mode_house_size)
```

```
## [1] 2
```

```
print(mode_age)
```

```
## [1] 42 64
```

```
print(mode_bmi)
```

```
## [1] NA
```

```
calculate_mode <- function(data) {
  uniq_vals <- unique(data)
  uniq_counts <- table(data)
  mode_value <- uniq_vals[which.max(uniq_counts)]
  return(mode_value)
}
```

```
# Calculate the mode using the user-defined function
mode_house_size <- calculate_mode(HSE_2011$HHSize)
mode_age <- calculate_mode(HSE_2011$Age)
```

Removing the negative bmi entries

```
mode_bmi <- HSE_2011 %>% filter(bmival > 0)
```

```
mode_bmi <- calculate_mode(mode_bmi$Age)
```

```
# Print the mode
print(mode_house_size)
```

```
## [1] 3
```

```
print(mode_age)
```

```
## [1] 3
```

```
print(mode_bmi)
```

```
## [1] 21
```

```
print(mode_bmi)
```

```
## [1] 21
```

3. Inferential Statistics.

a. Run a significance test to find out which gender drinks more alcohol.

The null hypothesis (H0) is that there is no difference in alcohol consumption between genders

The Alternative hypothesis (HA) is that there is difference in consumption between genders

```
#Create a subset with drinking information#Checking for data type dnow
drink <- HSE_2011 %>% select(Sex,dnnow)
```

```
#Checking for data type dnow
str(drink$dnnow)
```

```
##  dbl+lbl [1:10617]  2,  1,  1,  2,  1,  1,  1,  2,  1,  1,  1,  1, NA, NA, ...
##  @ label        : chr "Whether drink nowadays"
##  @ format.spss  : chr "F2.0"
##  @ display_width: int 7
##  @ labels       : Named num [1:5] -9 -8 -1 1 2
##   ..- attr(*, "names")= chr [1:5] "Refusal" "Don't know" "Item not applicable" "Yes" ...
```

```r
# Get Counts for of whether drink by gender
xtabs(~ dnnow + Sex, data = drink)
```

```
##      Sex
## dnnow    1    2
##     1 3172 3540
##     2  605 1217
```

```r
# calculating percentages of alcohol status by gender
drink_percent <- na.omit(drink) %>%
  group_by(Sex,dnnow) %>%
  summarise(Percentage = n() / nrow(na.omit(drink)) * 100)
```

```
## `summarise()` has grouped output by 'Sex'. You can override using the `.groups`
## argument.
```

```r
drink_percent
```

```
## # A tibble: 4 x 3
## # Groups:   Sex [2]
##   Sex        dnnow     Percentage
##   <dbl+lbl>  <dbl+lbl>      <dbl>
## 1 1 [Male]   1 [Yes]         37.2
## 2 1 [Male]   2 [No]           7.09
## 3 2 [Female] 1 [Yes]         41.5
## 4 4 2 [Female] 2 [No]         14.3
```

```r
# We use Chi-square test since both sex and dnnow are categorical variables

response <- c('Yes','No')
male_counts <- c(3172, 605)
female_counts <- c(3540,1217)

#Creating a merged table

drink_status <- rbind(male_counts,female_counts)

#Performing a chi-square test
chisq.test(drink_status)
```

```
##
##  Pearson's Chi-squared test with Yates' continuity correction
##
## data:  drink_status
## X-squared = 114.15, df = 1, p-value < 2.2e-16
```

#p-value is 2.2e-16 which less than 0.05, we have strong evidence to reject the null hypothesis in favor of the alternative hypothesis, suggesting that there is a significant association between alcohol consumption and gender.

a Run a significance test to find out which region drinks the most alcohol.

The null hypothesis (H0) is that there is no difference in the level of alcohol consumption among regions

The Alternative hypothesis (HA) is that there is difference in the level of alcohol consumption among regions

```
#Create a subset with drinking information
drink_region <- HSE_2011 %>% select(Origin,dnnow)
```

```
#Checking for data type Origin
str(drink_region$Origin)
```

```
##  dbl+lbl [1:10617] 1, 1, 1, 1, 1, 9, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,...
##  @ label      : chr "Ethnic origin of individual"
##  @ format.spss: chr "F3.0"
##  @ labels     : Named num [1:22] -9 -8 -2 -1 1 2 3 4 5 6 ...
##   ..- attr(*, "names")= chr [1:22] "Refusal" "Don't Know" "Schedule not applicable" "Item not applica
```

```
val_labels(drink_region$Origin)
```

```
##                                             Refusal
##                                                  -9
##                                          Don't Know
##                                                  -8
##                                Schedule not applicable
##                                                  -2
##                                   Item not applicable
##                                                  -1
## White - English/Welsh/Scottish/Northern Irish/British
##                                                   1
##                                         White - Irish
##                                                   2
##                       White - Gypsy or Irish Traveller
##                                                   3
##                             Any other white background
##                                                   4
##                              White and Black Caribbean
##                                                   5
##                                White and Black African
##                                                   6
##                                       White and Asian
##                                                   7
##            Any other mixed/multiple ethnic background
##                                                   8
##                                              Indian
```

```
##                                                  9
##                                           Pakistani
##                                                 10
##                                         Bangladeshi
##                                                 11
##                                            Chinese
##                                                 12
##                               Any other Asian background
##                                                 13
##                                            African
##                                                 14
##                                           Caribbean
##                                                 15
##          Any other Black/African/Caribbean background
##                                                 16
##                                               Arab
##                                                 17
##              Any other ethnic group (please describe)
##                                                 18
```

```
# Get Counts for of whether drink by gender
xtabs(~ dnnow + Origin, data = drink_region)
```

```
##      Origin
## dnnow    1    2    3    4    5    6    7    8    9   10   11   12   13   14
##     1 5925   62    2  326   23    8   17   18  100    6    5   26   52   46
##     2 1219   15    1   88    3    2   13   13  105  134   41    8   45   72
##      Origin
## dnnow   15   16   17   18
##     1   53   18    4   11
##     2   25    4   17   15
```

```
# calculating percentages of alcohol status by origin
drink_region_percent <- na.omit(drink_region) %>%
  group_by(Origin,dnnow) %>%
  summarise(Percentage = n() / nrow(na.omit(drink_region)) * 100)
```

```
## `summarise()` has grouped output by 'Origin'. You can override using the
## `.groups` argument.
```

```
drink_region_percent
```

```
## # A tibble: 36 x 3
## # Groups:   Origin [18]
##    Origin                                                    dnnow    Percentage
##    <dbl+lbl>                                                 <dbl+lb>      <dbl>
##  1 1 [White - English/Welsh/Scottish/Northern Irish/British] 1 [Yes]     69.5
##  2 1 [White - English/Welsh/Scottish/Northern Irish/British] 2 [No]      14.3
##  3 2 [White - Irish]                                         1 [Yes]      0.728
##  4 2 [White - Irish]                                         2 [No]       0.176
##  5 3 [White - Gypsy or Irish Traveller]                      1 [Yes]      0.0235
##  6 3 [White - Gypsy or Irish Traveller]                      2 [No]       0.0117
```

```
##  7 4 [Any other white background]                                1 [Yes]      3.83
##  8 4 [Any other white background]                                2 [No]       1.03
##  9 5 [White and Black Caribbean]                                 1 [Yes]      0.270
## 10 5 [White and Black Caribbean]                                 2 [No]       0.0352
## # i 26 more rows
```

```r
# We use Chi-square test since both sex and dnnow are categorical variables

response <- c('Yes','No')
white <- c(5925,1219)
w_irish <- c(62,15)
w_traveller <- c(2,1)
w_bg <- c(326,88)
w_caribean <- c(23,3)
w_ba <- c(8,2)
w_asian <- c(17,13)
mixed_bg <- c(18,13)
indian <- c(100,105)
pakistani <- c(6,134)
bangladesh <- c(5,41)
chinese <- c(26,8)
asian_bg <- c(52,45)
african <- c(46,72)
caribean <- c(53,25)
black_bg <- c(18,4)
arab <- c(4,7)
other <- c(11,15)

#Creating a merged table

region_drink_status <- rbind(white,w_irish,w_traveller,w_bg,w_caribean,w_ba,w_asian,mixed_bg,indian,paki

#Performing a chi-square test
chisq.test(region_drink_status, simulate.p.value=TRUE)
```

```
##
##  Pearson's Chi-squared test with simulated p-value (based on 2000
##  replicates)
##
## data:  region_drink_status
## X-squared = 979.74, df = NA, p-value = 0.0004998
```

The graph show region 1 (White - English/Welsh/Scottish/Northern Irish/British) with highest consentration of alcohol consumption

#C. Investigate whether there is a statistical difference between men and women on the following variables:
Valid height.

Null Hypothesis (H0): There is no difference in height between men and women.

Alternative Hypothesis (H1): There is a difference in height between men and women.

```
var_label(HSE_2011)
```

```
## $hserial
## [1] "Serial number of household"
##
## $pserial
## [1] "Serial number of Individual"
##
## $HHSize
## [1] "(D) Household size"
##
## $tenureb
## [1] "Household tenure"
##
## $Sex
## [1] "Sex"
##
## $Age
## [1] "Age last birthday"
##
## $MonthAge
## [1] "Age in months for infants under 1"
##
## $WeekAge
## [1] "Age in weeks for infants under 2 years"
##
## $PersNo
## [1] "Person number"
##
## $topqual3
## [1] "(D) Highest Educational Qualification"
##
## $HRPID
## [1] "Household Reference Person identifier"
##
## $econact
## [1] "(D) Economic Status (4 groups)"
##
## $nssec8
## [1] "(D) NS-SEC 8 variable classification (individual)"
##
## $Origin
## [1] "Ethnic origin of individual"
##
```

```
## $totinc
## [1] "(D) Total Household Income"
##
## $eqvinc
## [1] "(D) Equivalised Income"
##
## $NurOutc
## [1] "Outcome of nurse visit"
##
## $relto01
## [1] "Relationship to person 1"
##
## $relto02
## [1] "Relationship to person 2"
##
## $relto03
## [1] "Relationship to person 3"
##
## $relto04
## [1] "Relationship to person 4"
##
## $relto05
## [1] "Relationship to person 5"
##
## $relto06
## [1] "Relationship to person 6"
##
## $relto07
## [1] "Relationship to person 7"
##
## $relto08
## [1] "Relationship to person 8"
##
## $relto09
## [1] "Relationship to person 9"
##
## $Relto10
## [1] "Relationship to person 10"
##
## $Relto11
## [1] "Relationship to person 11"
##
## $Relto12
## [1] "Relationship to person 12"
##
## $ReltoHRP
## [1] "Relationship to Household Reference Person"
##
## $marstatc
## [1] "(D) Marital status including cohabitees"
##
## $SHA
## [1] "Strategic Health Authority"
##
```

```
## $gor1
## [1] "Government Office Region - numeric"
##
## $wt_int
## [1] "HSE 2011 Weight for analysis of core interview sample"
##
## $wt_nurse
## [1] "hse 2011 Weight for analysis of core nurse sample"
##
## $SayWgt
## [1] "How views own weight"
##
## $SayDiet
## [1] "Whether trying to lose or gain weight"
##
## $htval
## [1] "(D) Valid height (cm)"
##
## $wtval
## [1] "(D) Valid weight (Kg) inc. estimated>130kg"
##
## $bmival
## [1] "(D) Valid BMI"
##
## $whval
## [1] "(D) Valid Mean Waist/Hip ratio"
##
## $omdiaval
## [1] "(D) Omron Valid Mean Diastolic BP"
##
## $omsysval
## [1] "(D) Omron Valid Mean Systolic BP"
##
## $dnnow
## [1] "Whether drink nowadays"
##
## $totalwu
## [1] "(D) Total units of alcohol/week"
##
## $porfv
## [1] "(D) Total portion of fruit and veg"
##
## $acutill
## [1] "(D) Acute sickness last two weeks"
##
## $IllsM1
## [1] "Type of illness - 1st"
##
## $IllsM2
## [1] "Type of illness - 2nd"
##
## $IllsM3
## [1] "Type of illness - 3rd"
##
```

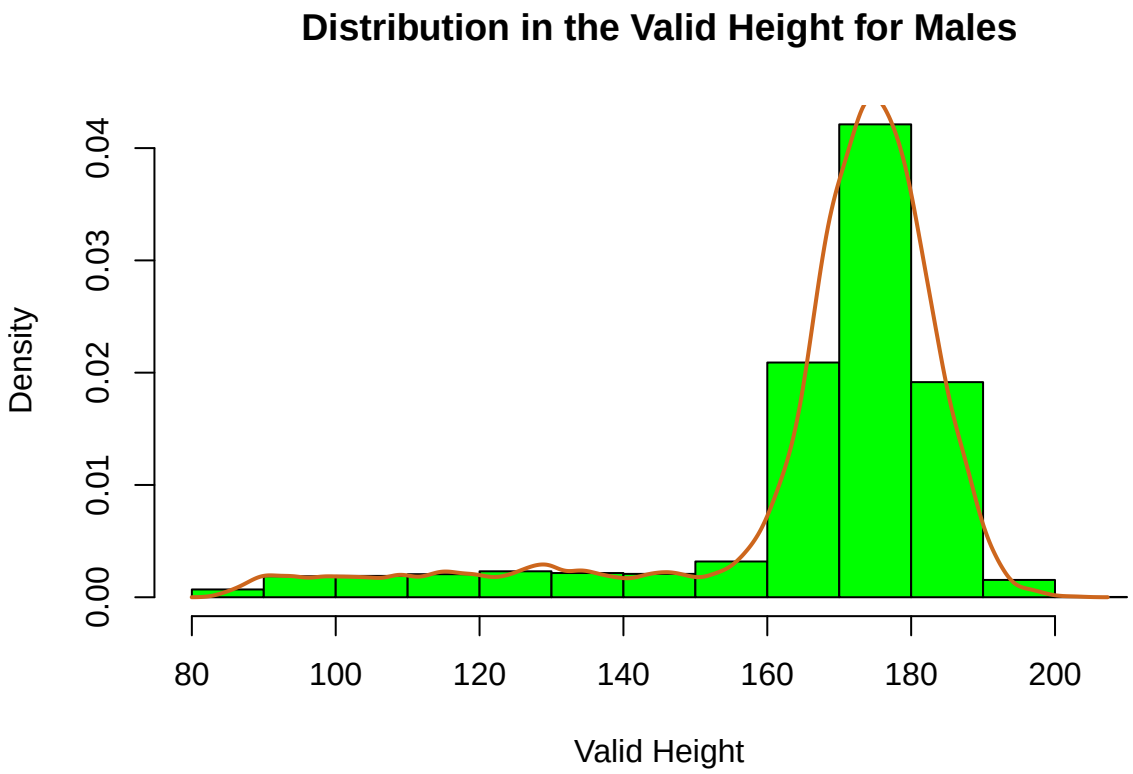
```
## $IllsM4
## [1] "Type of illness - 4th"
##
## $IllsM5
## [1] "Type of illness - 5th"
##
## $IllsM6
## [1] "Type of illness - 6th"
##
## $limitill
## [1] "(D) Limiting longstanding illness"
##
## $medcnj
## [1] "(D) Whether taking medication - excluding contraceptives only"
##
## $genhelf2
## [1] "(D) Self-assessed general health - grouped"
##
## $cigst1
## [1] "(D) Cigarette Smoking Status - Never/Ex-reg/Ex-occ/Current"
##
## $cigst2
## [1] "(D) Cigarette Smoking Status - Banded current smokers"
```

```
#create subset with sex, height and weight

height_weight <- HSE_2011 %>% select(Sex,htval,wtval)
```

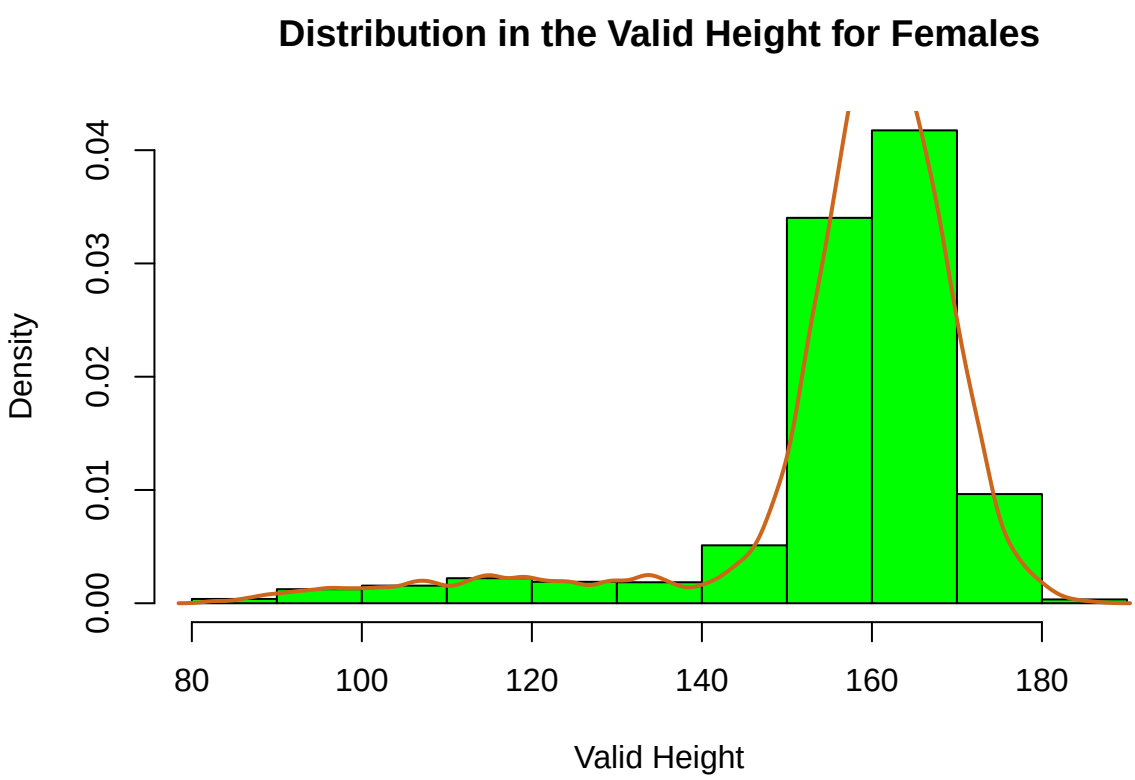
```
#Create separate datasets for each sex category
males_data <- height_weight %>% filter(Sex==1)
females_data <- height_weight %>% filter(Sex==2)
```

#check for normal distribution in the valid height data

```
# Using histogram ot check distribution in the height for Males
hist(males_data$htval,
     col="green",
     border="black",
     prob = TRUE,
     xlab = "Valid Height",
     main = "Distribution in the Valid Height for Males")

lines(density(males_data$htval,na.rm = TRUE),
      lwd = 2,
      col = "chocolate3")
```

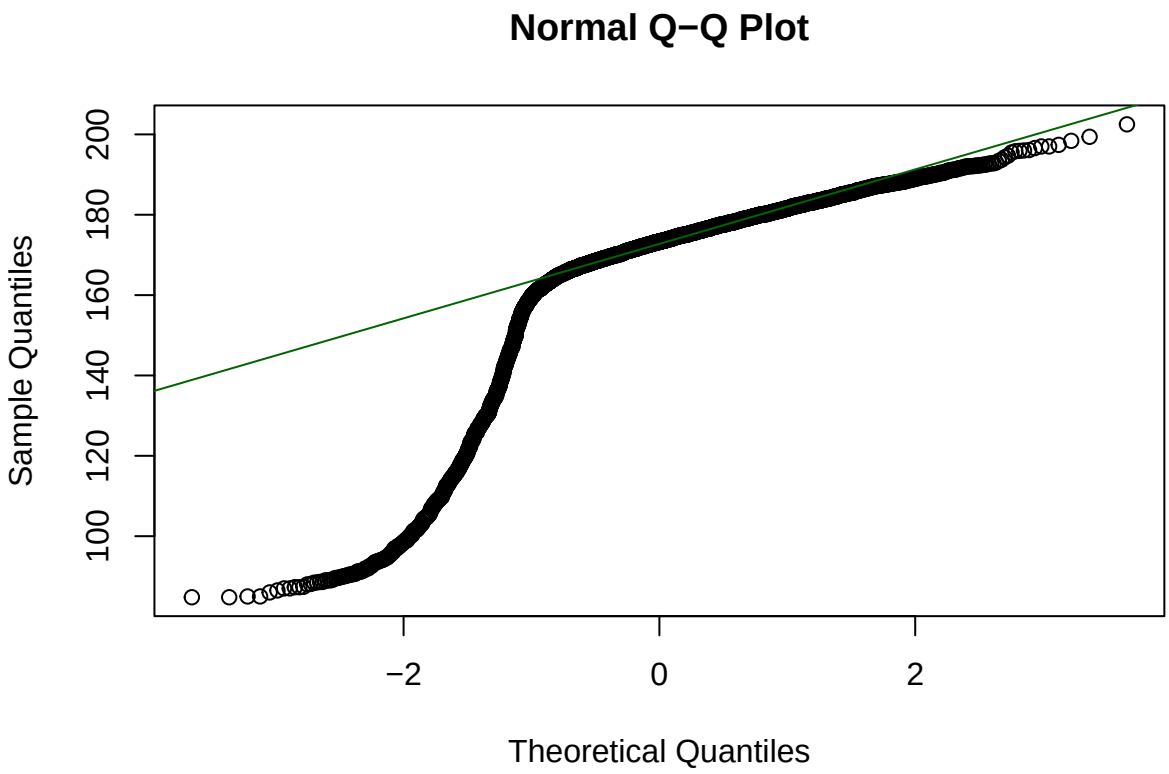



```
# Using histogram ot check distribution in the height for Females
hist(females_data$htval,
     col="green",
     border="black",
     prob = TRUE,
     xlab = "Valid Height",
     main = "Distribution in the Valid Height for Females")

lines(density(females_data$htval,na.rm = TRUE),
      lwd = 2,
      col = "chocolate3")
```



check for normal distribution of the data for male group using QQplot

```
# QQplot of normally distributed values in the male group
qqnorm(males_data$htval)

# Add qqline to plot
qqline(males_data$htval, col = "darkgreen")
```



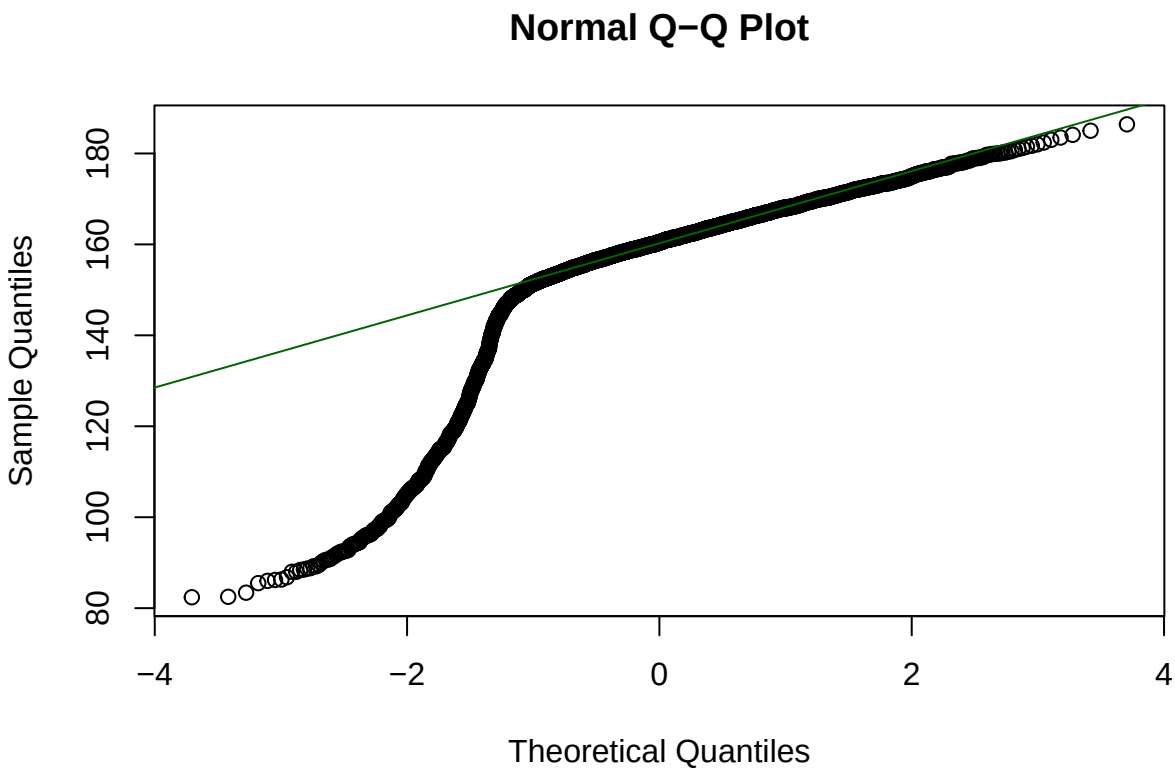
There are a significant number of data point off the line in the qqplot therefore the data does not follow a normal distribution

```
shapiro.test(males_data$htval)
```

```
##
##  Shapiro-Wilk normality test
##
## data:  males_data$htval
## W = 0.73755, p-value < 2.2e-16
```

```
# the Shapiro-Wilk normality test p-value is 2.2e-16, which is less than 0.05 means does not follow a n
```

```
# QQplot of normally distributed height values for the female group
qqnorm(females_data$htval)

# Add qqline to plot
qqline(females_data$htval, col = "darkgreen")
```



There are a significant number of data point off the line in the qqplot therefore the data does not follow a normal distribution

Since data is non parametric we are using the Man-whitney U test to check whether there is a statistical difference between men and women in height.

```
wilcox_test_result <- wilcox.test(htval ~ Sex, data = height_weight)
wilcox_test_result
```

```
##
##  Wilcoxon rank sum test with continuity correction
##
## data:  htval by Sex
## W = 14713021, p-value < 2.2e-16
## alternative hypothesis: true location shift is not equal to 0
```

The p-value is 2.2e-16 which is less than 0.05, we reject the null hypothesis and say that the difference in height statistically significant between males and females

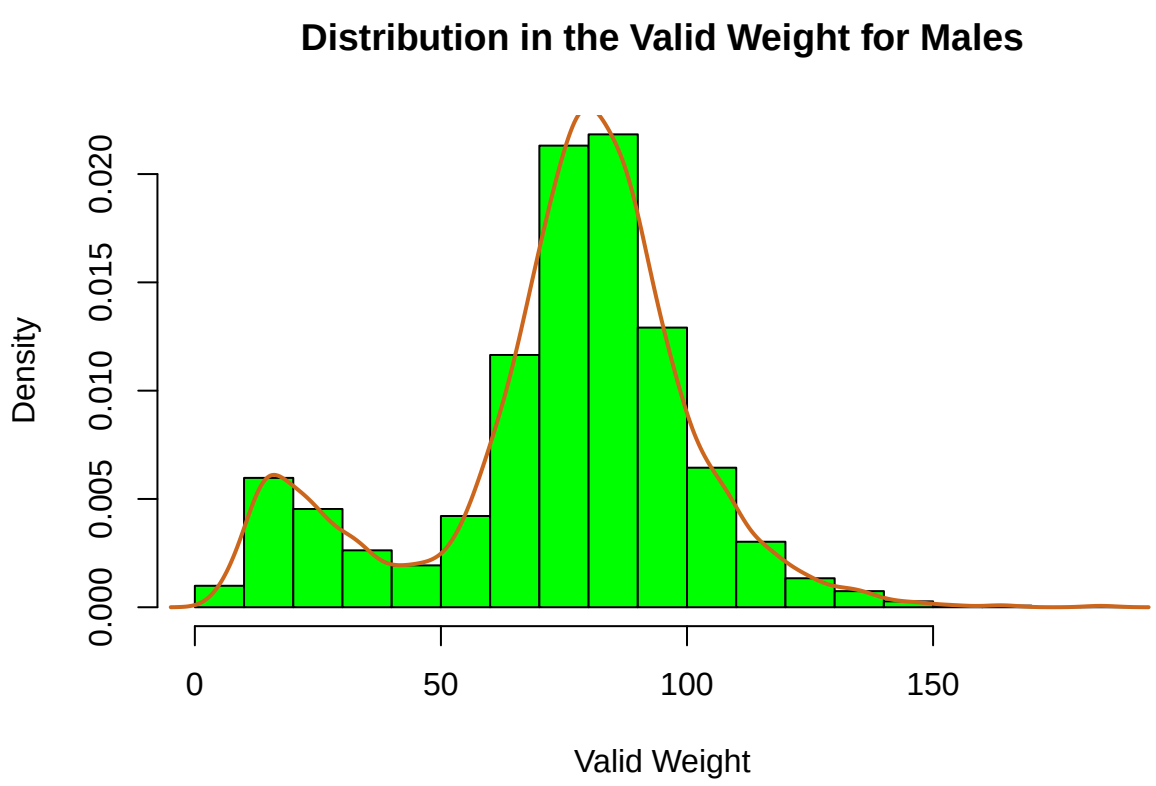
Valid weight.

Null Hypothesis (H0): There is no difference in weight. between men and women.

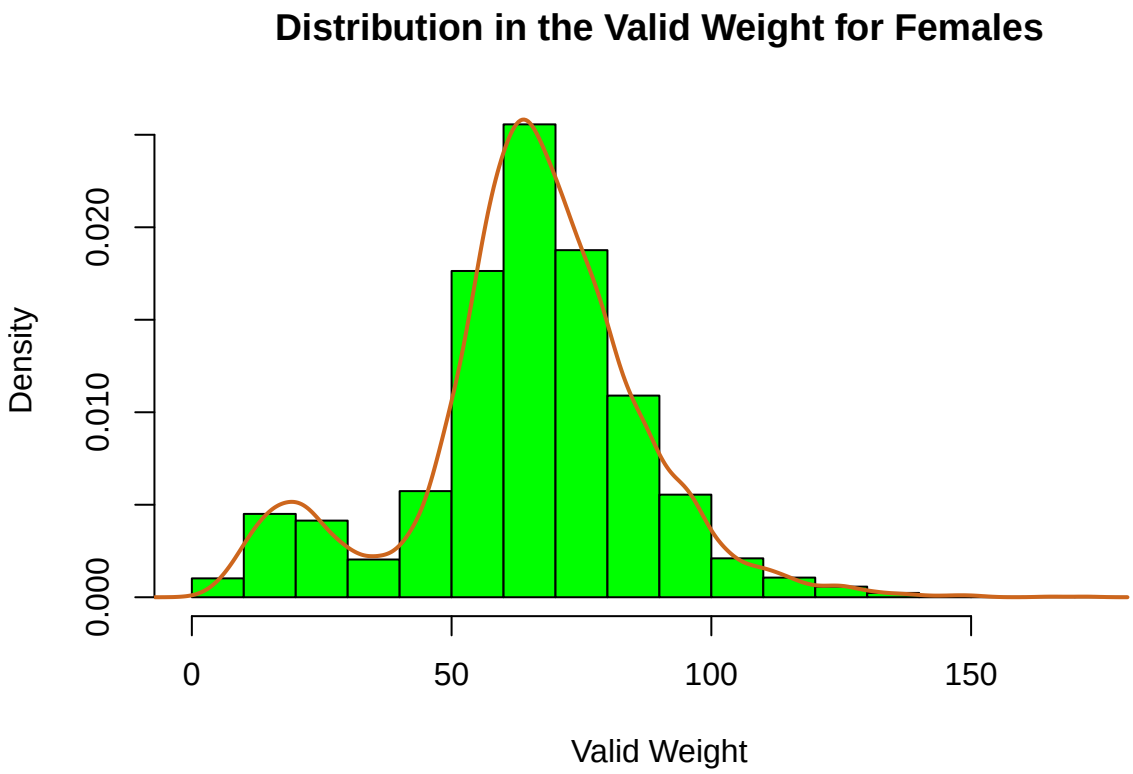
Alternative Hypothesis (H1): There is a difference in weight. between men and women.

#check for normal distribution in the valid Weight data

```
# Using histogram ot check distribution in the Weight for Males
hist(males_data$wtval,
     col="green",
     border="black",
     prob = TRUE,
     xlab = "Valid Weight",
     main = "Distribution in the Valid Weight for Males")

lines(density(males_data$wtval,na.rm = TRUE),
      lwd = 2,
      col = "chocolate3")
```

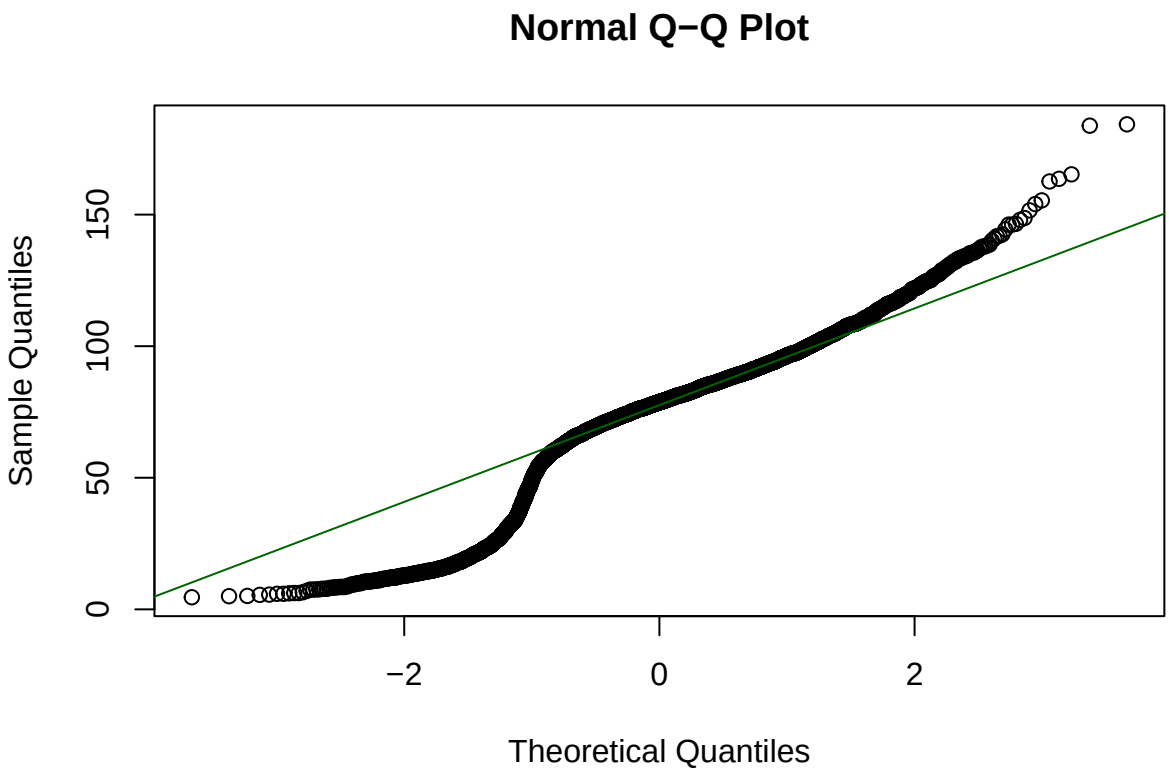



```
# Using histogram ot check distribution in the Weight for Females
hist(females_data$wtval,
     col="green",
     border="black",
     prob = TRUE,
     xlab = "Valid Weight",
     main = "Distribution in the Valid Weight for Females")

lines(density(females_data$wtval,na.rm = TRUE),
      lwd = 2,
      col = "chocolate3")
```



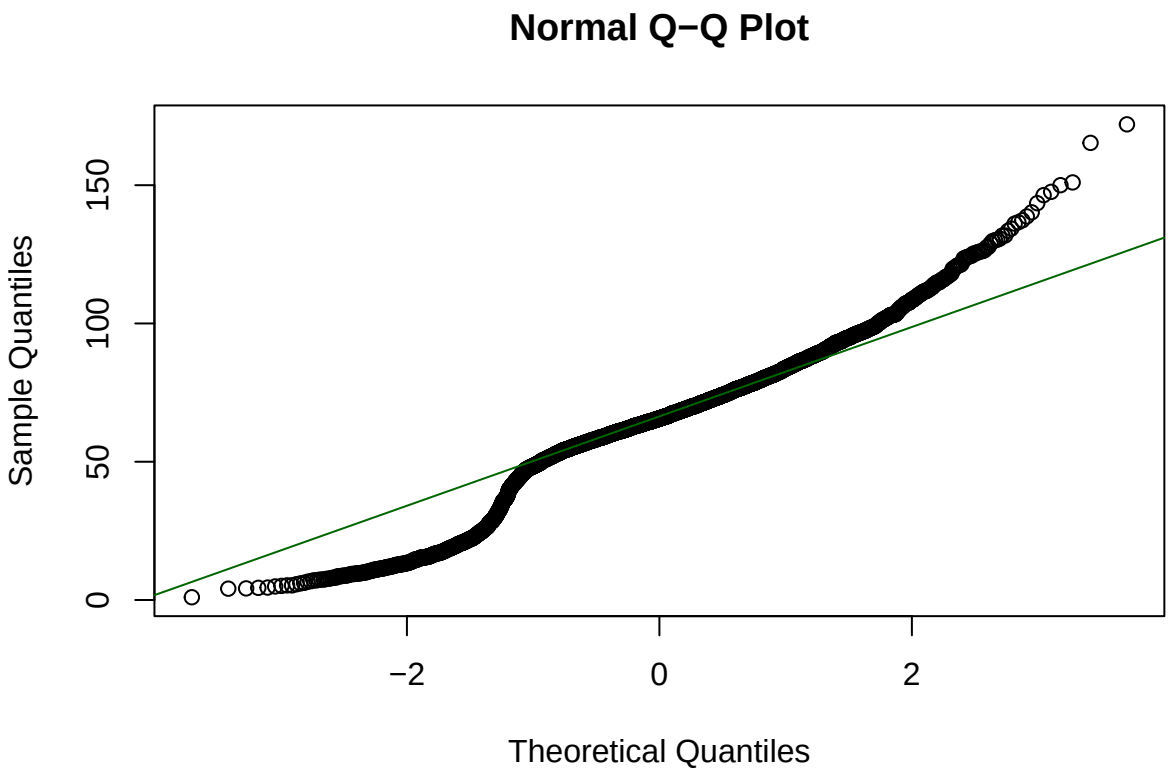
check for normal distribution of the data for male group using QQplot

```
# QQplot of normally distributed values in the male group
qqnorm(males_data$wtval)

# Add qqline to plot
qqline(males_data$wtval, col = "darkgreen")
```



There are a significant number of data point off the line in the qqplot therefore the data does not follow a normal distribution

```r
# QQplot of normally distributed Weight values for the female group
qqnorm(females_data$wtval)

# Add qqline to plot
qqline(females_data$wtval, col = "darkgreen")
```




```
shapiro.test(males_data$wtval)
```

```
##
##  Shapiro-Wilk normality test
##
## data:  males_data$wtval
## W = 0.93674, p-value < 2.2e-16
```

```
# the Shapiro-Wilk normality test p-value is 2.2e-16, which is less than 0.05 means does not follow a n
```

There are a significant number of data point off the line in the qqplot therefore the data does not follow a normal distribution

Since data is non parametric we are using the Man-whitney U test to test whether there is a statistical difference between men and women on the Valid Weight variable.

```
wilcox_test_result <- wilcox.test(wtval ~ Sex, data = height_weight)
wilcox_test_result
```

```
##
##  Wilcoxon rank sum test with continuity correction
##
## data:  wtval by Sex
## W = 12449400, p-value < 2.2e-16
## alternative hypothesis: true location shift is not equal to 0
```

The p-value is 2.2e-16 which is less than 0.05, we reject the null hypothesis and say that the difference in Weight statistically significant between males and females

d. What is the correlation between whether a person drinks nowadays, total household income, age at last birthday and gender?

```
# use the Pearson correlation coefficient for continuous variables i.e we use cor() to calculates the c
# Test for normal distribution of Age, and Income

shapiro.test(HSE_2011$Age[0:5000])
```

```
##
##  Shapiro-Wilk normality test
##
## data:  HSE_2011$Age[0:5000]
## W = 0.96882, p-value < 2.2e-16
```

```
shapiro.test(HSE_2011$eqvinc[0:5000])
```

```
##
##  Shapiro-Wilk normality test
##
## data:  HSE_2011$eqvinc[0:5000]
## W = 0.78119, p-value < 2.2e-16
```

```
# the Shapiro-Wilk normality test p-value is 2.2e-16, which is less than 0.05 means data does not follo

cor_age_income = cor.test(HSE_2011$Age, HSE_2011$eqvinc, method = "spearman",exact = FALSE)

print(cor_age_income)
```

```
##
##  Spearman's rank correlation rho
##
## data:  HSE_2011$Age and HSE_2011$eqvinc
## S = 1.0618e+11, p-value = 1.125e-05
## alternative hypothesis: true rho is not equal to 0
## sample estimates:
##         rho
## -0.04769184
```

```r
cor_drink_income = cor.test(HSE_2011$dnnow, HSE_2011$eqvinc)
```

```r
print(cor_drink_income)
```

```
##
##  Pearson's product-moment correlation
##
## data:  HSE_2011$dnnow and HSE_2011$eqvinc
## t = -12.67, df = 6764, p-value < 2.2e-16
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.1754549 -0.1289022
## sample estimates:
##       cor
## -0.152263
```

```r
cor_drink_age = cor.test(HSE_2011$dnnow, HSE_2011$Age)
```

```r
print(cor_drink_age)
```

```
##
##  Pearson's product-moment correlation
##
## data:  HSE_2011$dnnow and HSE_2011$Age
## t = 6.3793, df = 8532, p-value = 1.871e-10
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.04775254 0.08998509
## sample estimates:
##        cor
## 0.06889968
```

```r
cor_drink_gender = cor.test(HSE_2011$dnnow, HSE_2011$Sex)
```

```r
print(cor_drink_gender)
```

```
##
##  Pearson's product-moment correlation
##
## data:  HSE_2011$dnnow and HSE_2011$Sex
## t = 10.782, df = 8532, p-value < 2.2e-16
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.0949586 0.1368223
## sample estimates:
##      cor
## 0.115942
```

```r
cor_income_drink = cor.test(HSE_2011$eqvinc, HSE_2011$dnnow)
```

```r
print(cor_income_drink)
```

```
##
##  Pearson's product-moment correlation
##
## data:  HSE_2011$eqvinc and HSE_2011$dnnow
## t = -12.67, df = 6764, p-value < 2.2e-16
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.1754549 -0.1289022
## sample estimates:
##       cor
## -0.152263
```

```r
cor_income_age = cor.test(HSE_2011$eqvinc, HSE_2011$Age)
```

```r
print(cor_income_age)
```

```
##
##  Pearson's product-moment correlation
##
## data:  HSE_2011$eqvinc and HSE_2011$Age
## t = -1.9791, df = 8470, p-value = 0.04784
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.0427743358 -0.0002051185
## sample estimates:
##         cor
## -0.02149947
```

```r
cor_income_gender = cor.test(HSE_2011$eqvinc, HSE_2011$Sex)
```

```r
print(cor_income_gender)
```

```
##
##  Pearson's product-moment correlation
##
## data:  HSE_2011$eqvinc and HSE_2011$Sex
## t = -4.2488, df = 8470, p-value = 2.172e-05
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.06734521 -0.02484686
## sample estimates:
##        cor
## -0.0461169
```

```r
cor_age_drink = cor.test(HSE_2011$Age, HSE_2011$dnnow)
```

```r
print(cor_age_drink)
```

```
##
##  Pearson's product-moment correlation
##
## data:  HSE_2011$Age and HSE_2011$dnnow
## t = 6.3793, df = 8532, p-value = 1.871e-10
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.04775254 0.08998509
## sample estimates:
##        cor
## 0.06889968
```

```r
cor_age_gender = cor.test(HSE_2011$Age, HSE_2011$Sex)
```

```r
print(cor_age_gender)
```

```
##
##  Pearson's product-moment correlation
##
## data:  HSE_2011$Age and HSE_2011$Sex
## t = 3.3695, df = 10615, p-value = 0.0007558
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.01367304 0.05167641
## sample estimates:
##        cor
## 0.03268654
```