practice_exercise

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```r
practice_data = read_excel("./data/Practice_exercise.xlsx", sheet = "Data") %>%
  janitor::clean_names() %>%
  select(observation_number,quarter,employee_id, sex = sex_male_1, race, age, hospital_visit = hospital_
  mutate(
    age_cat = case_when(
      age < 30 ~ 1,
      age <= 45 ~ 2,
      age > 45 ~ 3
    )
  )
```

#Checking for missing data

```r
sapply(practice_data, function(x) sum(is.na(x)))
```

```
## observation_number            quarter        employee_id
##                  0                  0                  0
##                sex               race                age
##                 71               2123                  0
##     hospital_visit             salary       health_score
##                  0                  0                  0
##            age_cat
##                  0
```

#Checking for missing data

```r
practice_data %>%
  select(everything()) %>%  # replace to your needs
  summarise_all(funs(sum(is.na(.))))
```

```
## # A tibble: 1 x 10
##   observation_num~ quarter employee_id   sex  race   age hospital_visit
##              <int>   <int>       <int> <int> <int> <int>          <int>
## 1                0       0           0    71  2123     0              0
## # ... with 3 more variables: salary <int>, health_score <int>,
## #   age_cat <int>
```

#finding the minimum and maximum values of each variable

```r
sapply(practice_data, function(x) min(x))
```

```
## observation_number            quarter        employee_id
##       1.000000e+00       1.000000e+00       1.000000e+00
##                sex               race                age
##                   NA                   NA       7.000000e+00
##       hospital_visit               salary       health_score
##         0.000000e+00         2.835070e+04       6.265991e-01
##              age_cat
##         1.000000e+00
```

```
sapply(practice_data, function(x) max(x))
```

```
## observation_number            quarter        employee_id
##           19103.00              12.00            2000.00
##                sex               race                age
##                 NA                 NA             172.00
##     hospital_visit             salary       health_score
##               1.00           68826.34              10.00
##            age_cat
##               3.00
```

#checking the number of employees with health score outside the range of data

```
practice_data %>%
  count(
   health_sc_6 = ifelse(health_score > 6, 1, 0)
  )
```

```
## # A tibble: 2 x 2
##   health_sc_6     n
##         <dbl> <int>
## 1           0 17865
## 2           1  1238
```

```
practice_data %>%
  select(
    employee_id, sex
  ) %>%
  filter(
  is.na(sex)
  ) %>%
  group_by(
    employee_id
  ) %>%
  summarise(
    missing = sum(is.na(sex))
  )
```

```
## # A tibble: 7 x 2
##   employee_id missing
##         <dbl>   <int>
## 1        1994      10
## 2        1995       9
## 3        1996      12
## 4        1997      11
## 5        1998      12
## 6        1999       7
## 7        2000      10
```

```
practice_data %>%
  select(
    employee_id, race
  ) %>%
  filter(
     is.na(race)
  ) %>%
  group_by(
    employee_id
  ) %>%
  summarise(
    miss = sum(is.na(race))
  )
```

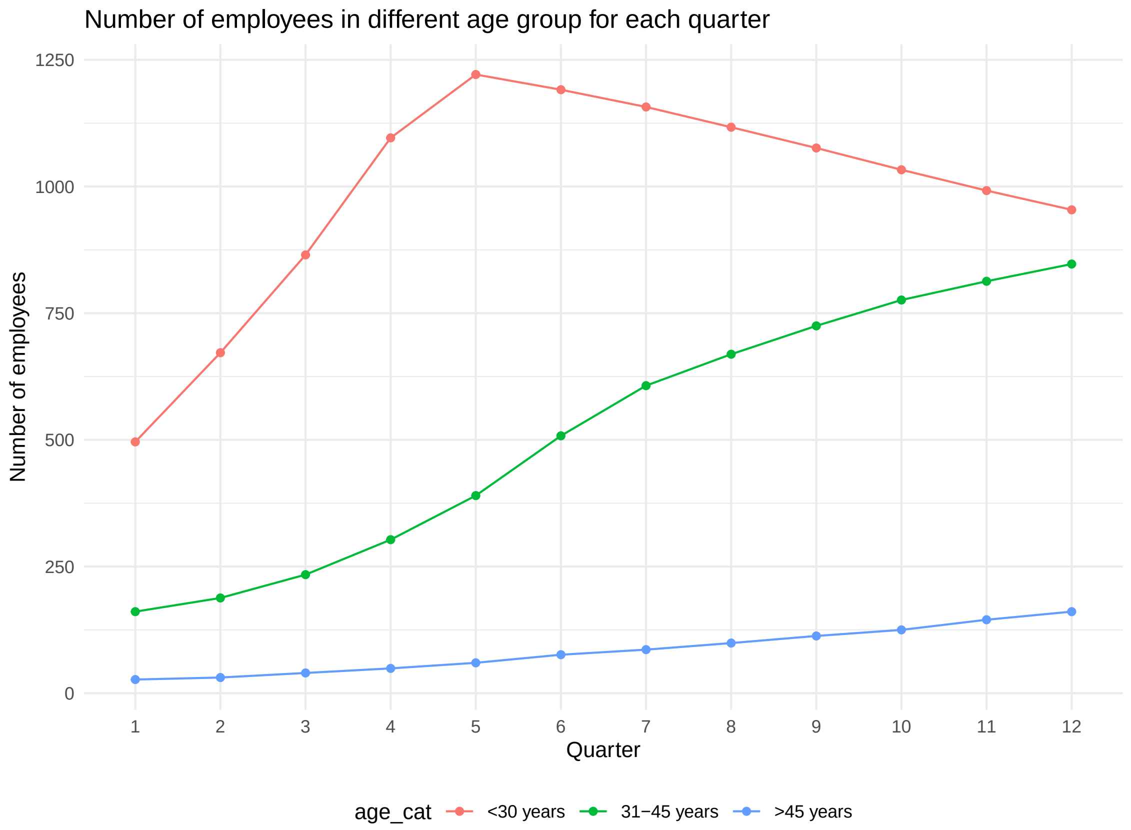
```
## # A tibble: 220 x 2
##    employee_id  miss
##          <dbl> <int>
##  1           8    10
##  2          10    12
##  3          13     9
##  4          22     9
##  5          36    12
##  6          38    12
##  7          48    10
##  8          49     7
##  9          51     8
## 10          55     9
## # ... with 210 more rows
```

#Calculating the number of employees in each age group for each quarter

```
emp_data = practice_data %>%
  mutate(
    quarter = factor(
    quarter),
    age_cat = factor(age_cat)
  )
```

```
emp_data = emp_data %>%
  select(
    employee_id, quarter, age_cat
  ) %>%
  group_by(
    quarter, age_cat
  ) %>%
  tally()
```

```
e <- ggplot(emp_data, aes(x = quarter, y = n, group = age_cat)) +
  geom_line(aes(color = age_cat)) +
  geom_point(aes(color = age_cat)) + labs(x = "Quarter", y = "Number of employees", title = "Number of
e
```



#checking the trend in average salary over time

```
practice_data %>%
  select(
    salary, quarter
  ) %>%
  group_by(
    quarter
  ) %>%
  summarise(
    avg_salary = mean(salary)
  )
```

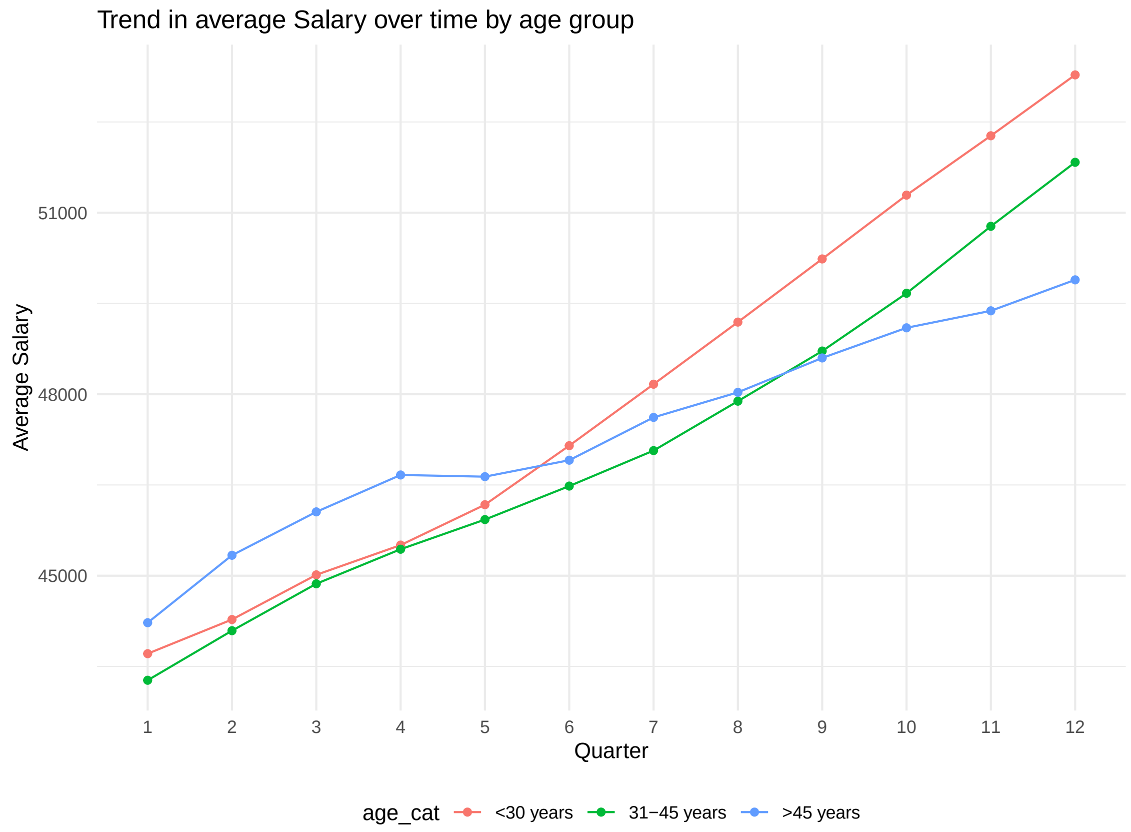
```
## # A tibble: 12 x 2
##    quarter avg_salary
##      <dbl>      <dbl>
##  1       1     43628.
##  2       2     44274.
##  3       3     45021.
##  4       4     45531.
##  5       5     46133.
##  6       6     46948.
##  7       7     47780.
##  8       8     48667.
##  9       9     49562.
## 10      10     50498.
## 11      11     51433.
## 12      12     52376.
```

```
salary_data = practice_data %>%
  mutate(
    age_cat = factor(age_cat),
quarter = factor(quarter))
```

#checking the trend in average salary over time by age group

```
salary_data = salary_data %>%
  select(
    salary, quarter, age_cat
  ) %>%
  group_by(
    quarter, age_cat
  ) %>%
  summarise(
    avg_salary = mean(salary)
  )
```

```
p <- ggplot(salary_data, aes(x = quarter, y = avg_salary, group = age_cat)) +
  geom_line(aes(color = age_cat)) +
  geom_point(aes(color = age_cat)) + labs(x = "Quarter", y = "Average Salary", title = "Trend in averag
p
```



#checking the trend in mean health score over time

```
hc = practice_data %>%
  select(
    health_score, quarter
  ) %>%
  group_by(
    quarter
  ) %>%
  summarise(
    avg_score = mean(health_score)
  )
```

#Mean health score over time by age group

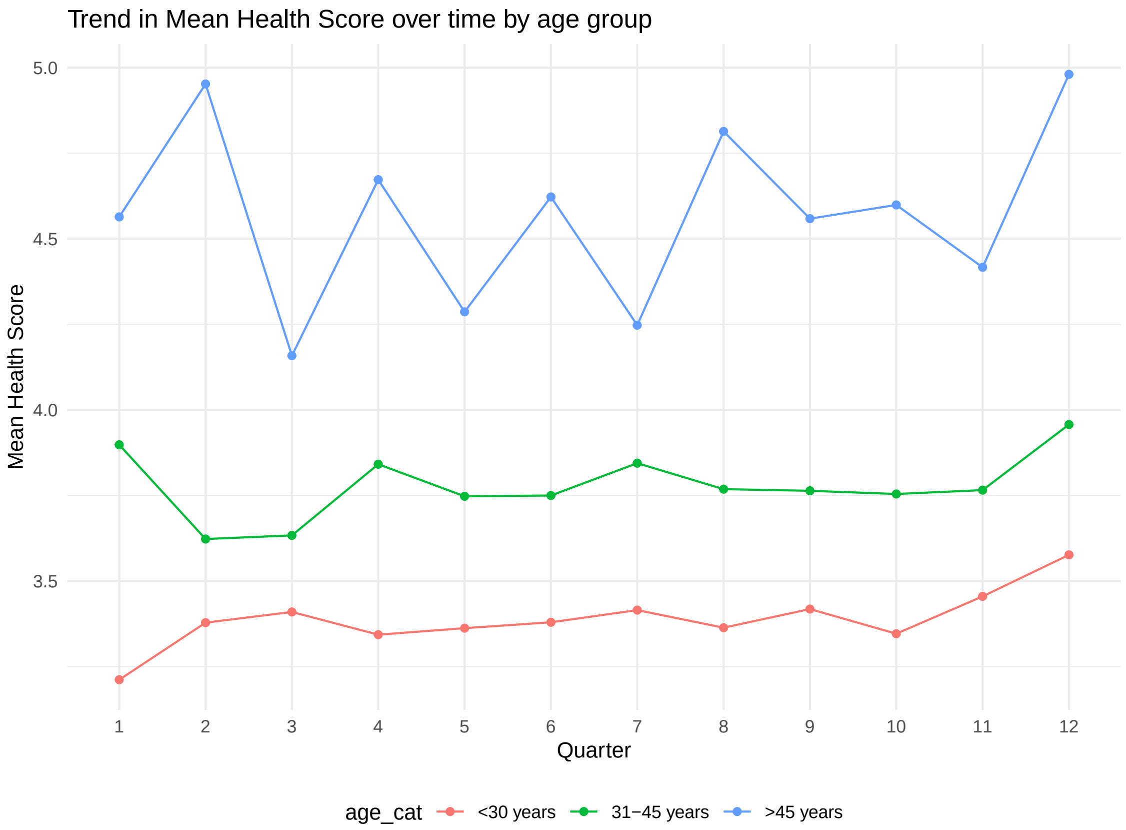
```
practice_data %>%
  select(
    health_score, quarter, age_cat
  ) %>%
  group_by(
    quarter, age_cat
  ) %>%
  summarise(
    avg_score = mean(health_score)
  )
```

```
## # A tibble: 36 x 3
## # Groups:   quarter [12]
##    quarter age_cat avg_score
##      <dbl>   <dbl>     <dbl>
##  1       1       1      3.21
##  2       1       2      3.90
##  3       1       3      4.56
##  4       2       1      3.38
##  5       2       2      3.62
##  6       2       3      4.95
##  7       3       1      3.41
##  8       3       2      3.63
##  9       3       3      4.16
## 10       4       1      3.34
## # ... with 26 more rows
```

```
health_sc = practice_data %>%
  mutate(
    age_cat = factor(age_cat),
quarter = factor(quarter))
```

```
health_sc = health_sc %>%
  select(
    health_score, quarter, age_cat
  ) %>%
  group_by(
    quarter, age_cat
  ) %>%
  summarise(
    avg_score = mean(health_score)
  )
```

```
p1 <- ggplot(health_sc, aes(x = quarter, y = avg_score, group = age_cat)) +
  geom_line(aes(color = age_cat)) +
  geom_point(aes(color = age_cat)) + labs(x = "Quarter", y = "Mean Health Score", title = "Trend in Mea
p1
```

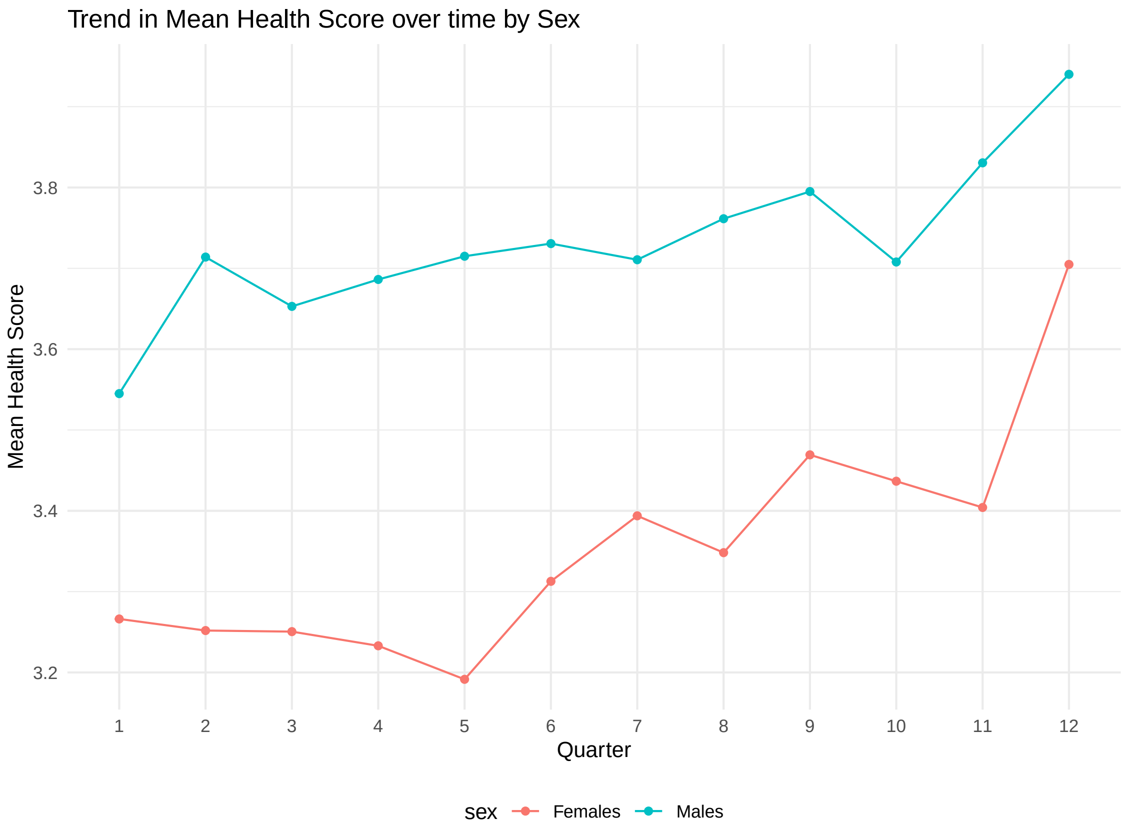


#Mean health score over time by sex

```
health_sex = practice_data %>%
  mutate(
    sex = factor(sex),
quarter = factor(quarter))
```

```
health_sex = health_sex %>%
  drop_na() %>%
  select(
    health_score, quarter, sex
  ) %>%
  group_by(
    quarter, sex
  ) %>%
  summarise(
    avg_score = mean(health_score)
  )
```

```
pq <- ggplot(health_sex, aes(x = quarter, y = avg_score, group = sex)) +
  geom_line(aes(color = sex)) +
  geom_point(aes(color = sex)) + labs(x = "Quarter", y = "Mean Health Score", title = "Trend in Mean Hea
pq
```

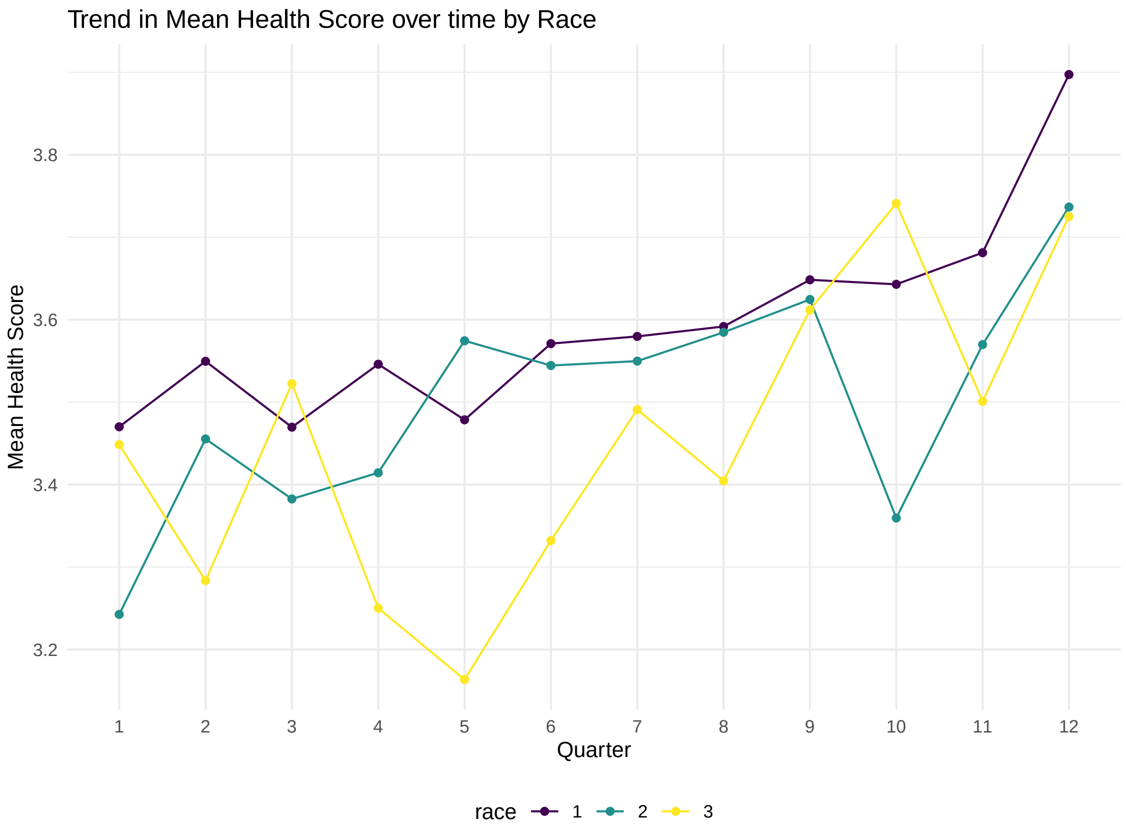


#Mean health score over time by race

```
health_race = practice_data %>%
  mutate(
    race = factor(race),
quarter = factor(quarter))
```

```
health_race = health_race %>%
  drop_na() %>%
  select(
    health_score, quarter, race
  ) %>%
  group_by(
    quarter, race
  ) %>%
  summarise(
    avg_score = mean(health_score)
  )
```

```
pe <- ggplot(health_race, aes(x = quarter, y = avg_score, group = race)) +
  geom_line(aes(color = race)) +
  geom_point(aes(color = race)) + labs(x = "Quarter", y = "Mean Health Score", title = "Trend in Mean He
pe
```



#correcting the data

```
new_data = practice_data %>%
  drop_na() %>%
  filter(
    health_score <= 6,
    age >= 14, age <= 75
  )
```

#checking the trend in mean health score over time

```
hc1 = new_data %>%
  select(
    health_score, quarter
  ) %>%
  group_by(
    quarter
  ) %>%
  summarise(
    avg_score = mean(health_score)
  )
```

```
sqldf("select quarter, age_cat, avg(health_score)as avg_score
    from new_data
    group by quarter, age_cat")
```

```
##    quarter age_cat avg_score
## 1        1       1  2.796936
## 2        1       2  3.388951
## 3        1       3  3.425028
## 4        2       1  2.989041
## 5        2       2  3.195572
## 6        2       3  3.988790
## 7        3       1  2.957211
## 8        3       2  3.287013
## 9        3       3  3.764033
## 10       4       1  2.980156
## 11       4       2  3.332257
## 12       4       3  3.922990
## 13       5       1  2.953362
## 14       5       2  3.348889
## 15       5       3  3.963946
## 16       6       1  2.997310
## 17       6       2  3.310626
## 18       6       3  3.863035
## 19       7       1  3.012671
## 20       7       2  3.440885
## 21       7       3  3.899116
## 22       8       1  2.970070
## 23       8       2  3.298553
## 24       8       3  4.017854
## 25       9       1  2.956768
## 26       9       2  3.397101
## 27       9       3  3.911494
## 28      10       1  2.961097
## 29      10       2  3.319969
## 30      10       3  3.710119
## 31      11       1  3.036244
## 32      11       2  3.357914
## 33      11       3  3.924474
## 34      12       1  3.113301
## 35      12       2  3.404411
## 36      12       3  3.954721
```

#Mean health score over time by age group

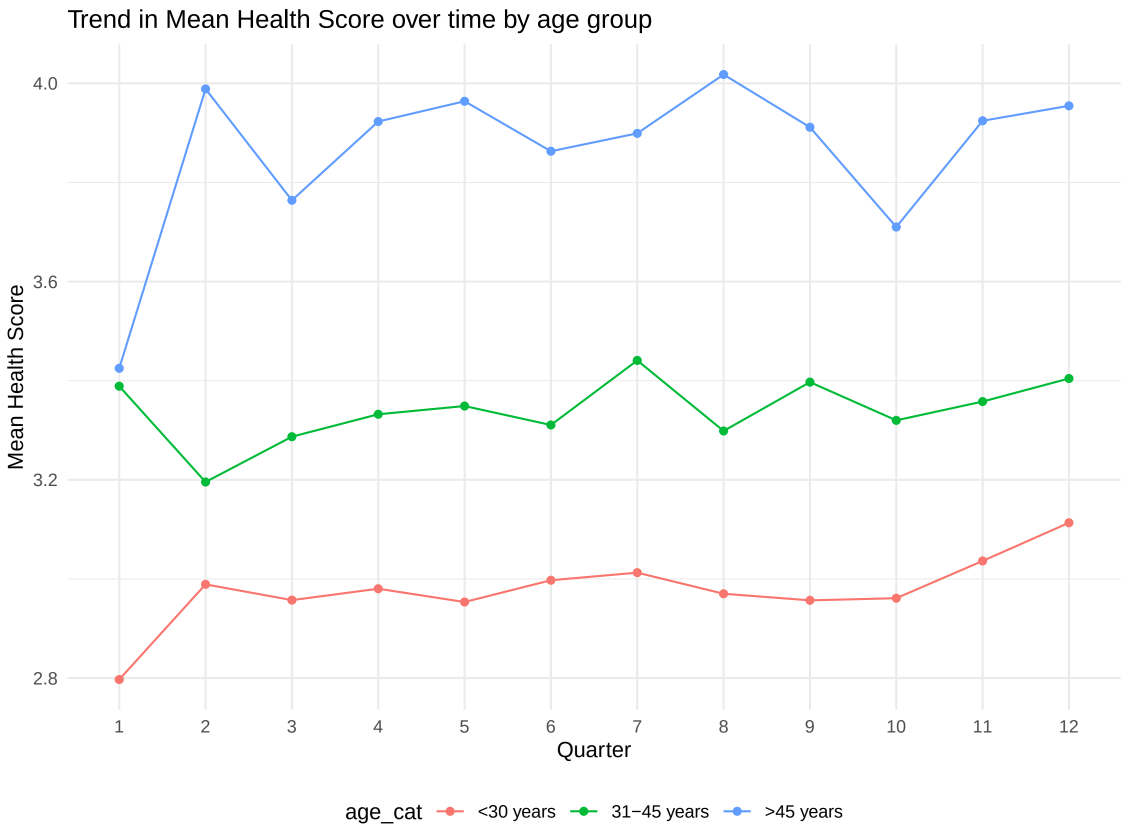
```r
new_data %>%
  select(
    health_score, quarter, age_cat
  ) %>%
  group_by(
    quarter, age_cat
  ) %>%
  summarise(
    avg_score = mean(health_score)
  )
```

```
## # A tibble: 36 x 3
## # Groups:   quarter [12]
##    quarter age_cat avg_score
##      <dbl>   <dbl>     <dbl>
##  1       1       1      2.80
##  2       1       2      3.39
##  3       1       3      3.43
##  4       2       1      2.99
##  5       2       2      3.20
##  6       2       3      3.99
##  7       3       1      2.96
##  8       3       2      3.29
##  9       3       3      3.76
## 10       4       1      2.98
## # ... with 26 more rows
```

```
health_score = new_data %>%
  mutate(
    age_cat = factor(age_cat),
quarter = factor(quarter))
```

```
health_score = health_score %>%
  select(
    health_score, quarter, age_cat
  ) %>%
  group_by(
    quarter, age_cat
  ) %>%
  summarise(
    avg_score = mean(health_score)
  )
```

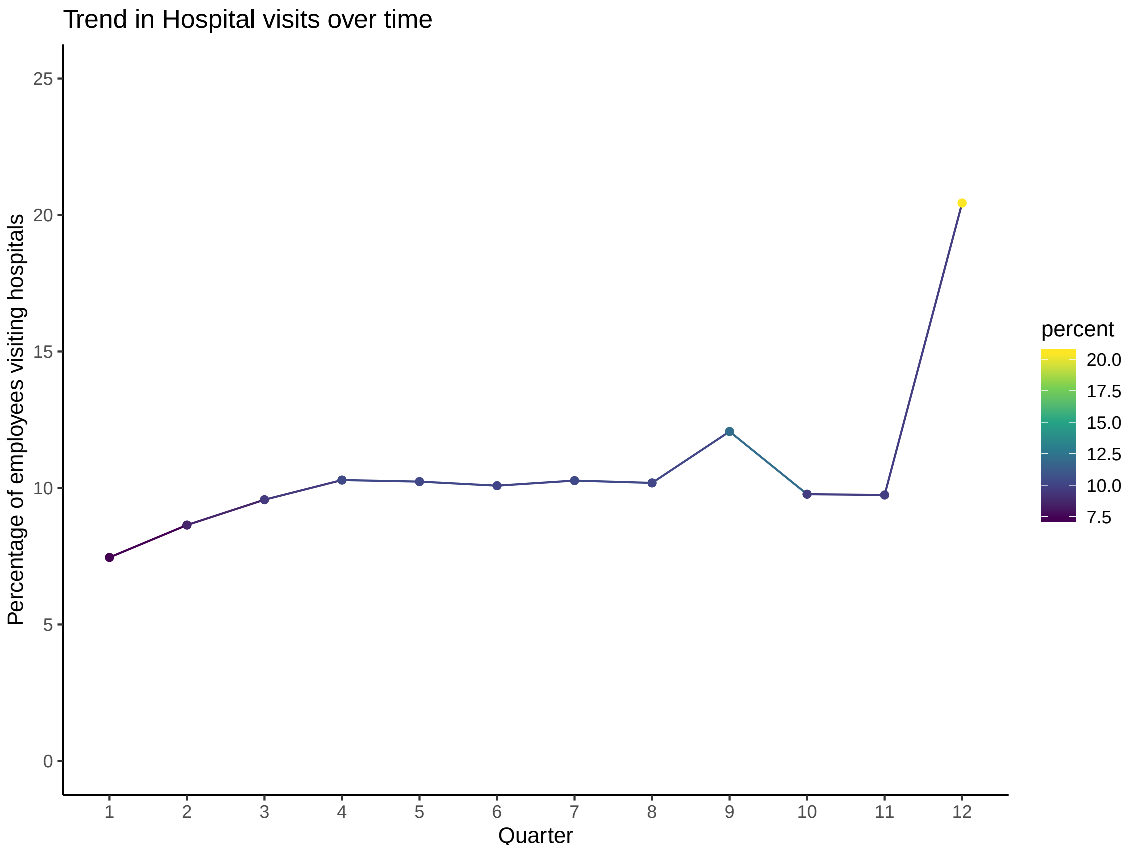
```
pn <- ggplot(health_score, aes(x = quarter, y = avg_score, group = age_cat)) +
  geom_line(aes(color = age_cat)) +
  geom_point(aes(color = age_cat)) + labs(x = "Quarter", y = "Mean Health Score", title = "Trend in Mea
pn
```



```
hosp = practice_data %>%

  select(
    employee_id, hospital_visit, quarter
  ) %>%
  group_by(
    quarter
  ) %>%
  summarise(
    percent = (sum(hospital_visit)/n())*100
  )
```

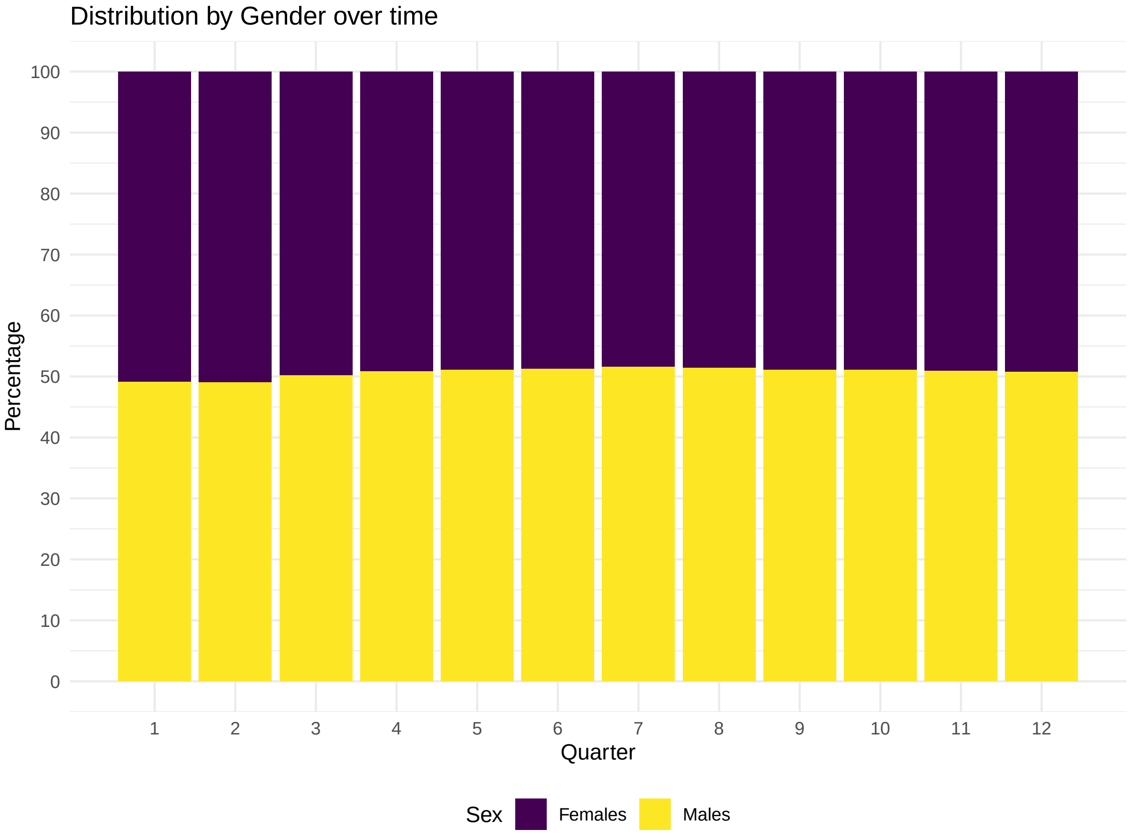
```
s <- ggplot(hosp, aes(x = quarter, y = percent, color = percent)) + theme_classic() + geom_line() + geor
   scale_x_discrete(name = "Quarter", limits = c("1","2","3","4","5","6","7","8","9","10","11","12")) +
  scale_y_continuous(name = "Percentage of employees visiting hospitals",
                           breaks = seq(0, 25, 5),
                           limits = c(0, 25)) + labs(x = "Quarter", y = "Percentage of employees visitin
s
```



```
w = practice_data %>%
  drop_na() %>%
  mutate(
    sex = factor(sex)
  ) %>%
  select(
     employee_id, quarter, sex
  ) %>%
  group_by(
    quarter, sex
  ) %>%
summarise(n = n()) %>%
mutate(freq = n / sum(n)*100)
w
```

```
## # A tibble: 24 x 4
## # Groups:   quarter [12]
##    quarter sex       n  freq
##      <dbl> <fct> <int> <dbl>
##  1       1 0       305  50.8
##  2       1 1       295  49.2
##  3       2 0       399  50.9
##  4       2 1       385  49.1
##  5       3 0       503  49.8
##  6       3 1       507  50.2
##  7       4 0       632  49.1
##  8       4 1       655  50.9
##  9       5 0       726  48.9
## 10       5 1       759  51.1
## # ... with 14 more rows
```

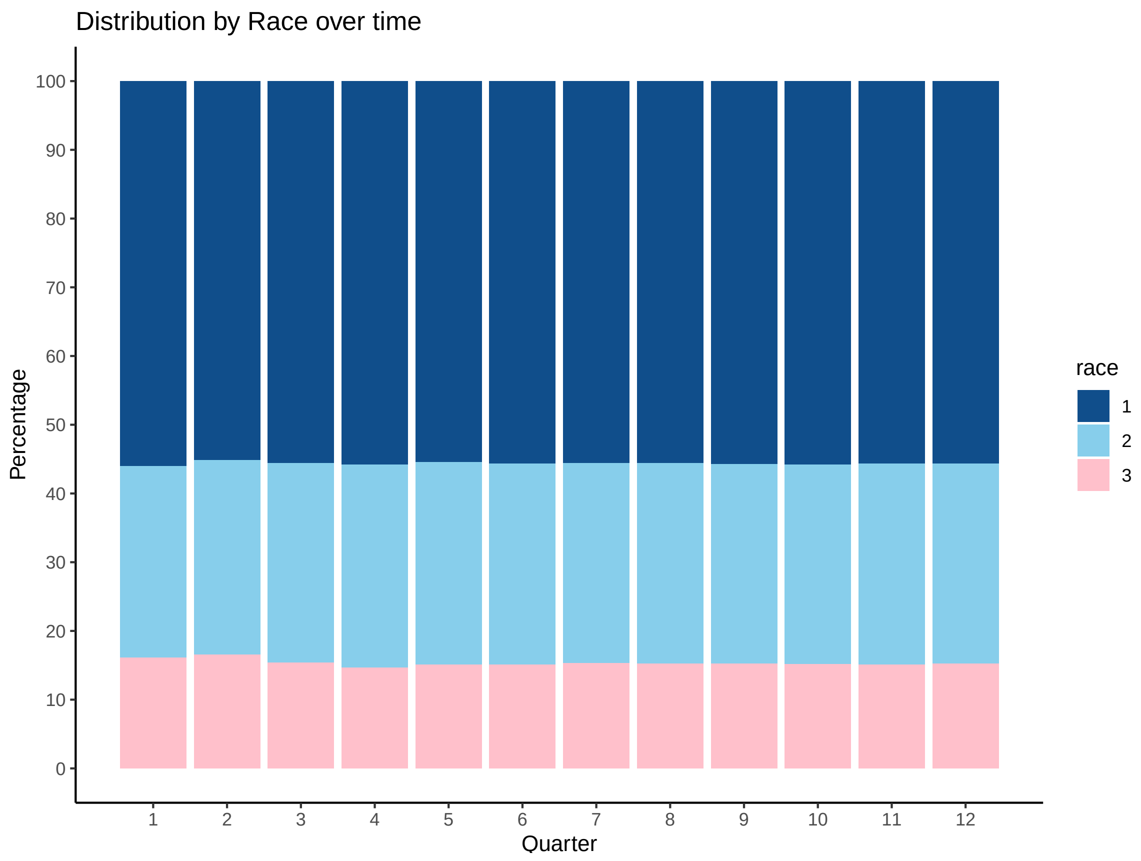
```
t = w %>%
  ggplot(aes(x = quarter, y = freq, fill = sex)) + geom_bar(stat = "identity", legend = c("Female", "Mal
  scale_y_continuous(name = "Percentage",
                         breaks = seq(0, 100, 10),
                         limits = c(0, 100)) + labs(x = "Quarter", y = "Percentage" , title = "Distril
t
```



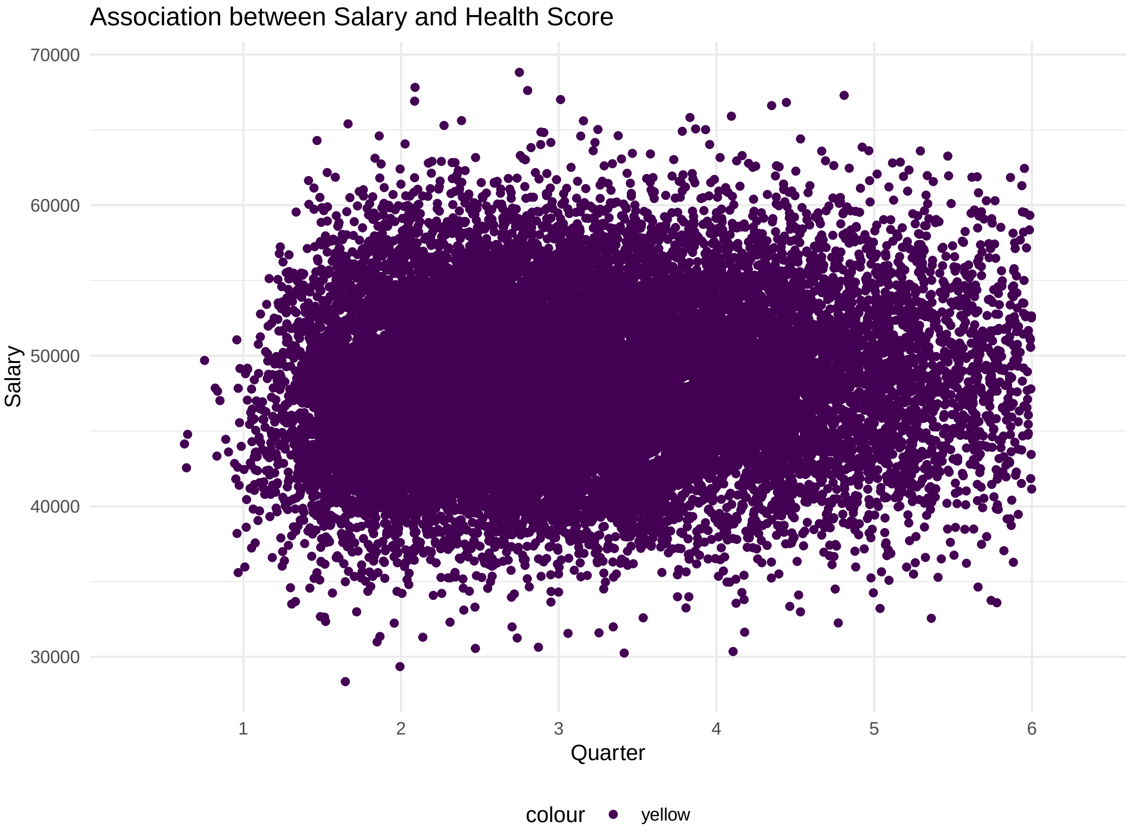
```
j = practice_data %>%
  drop_na() %>%
  mutate(
    race = factor(race)
  ) %>%
  select(
     quarter, race
  ) %>%
  group_by(
    quarter, race
  ) %>%
  summarise(n = n()) %>%
mutate(freq = n / sum(n)*100)
j
```

```
## # A tibble: 36 x 4
## # Groups:   quarter [12]
##    quarter race      n  freq
##      <dbl> <fct> <int> <dbl>
##  1       1 1       336  56.
##  2       1 2       167  27.8
##  3       1 3        97  16.2
##  4       2 1       432  55.1
##  5       2 2       222  28.3
##  6       2 3       130  16.6
##  7       3 1       561  55.5
##  8       3 2       293  29.0
##  9       3 3       156  15.4
## 10       4 1       718  55.8
## # ... with 26 more rows
```

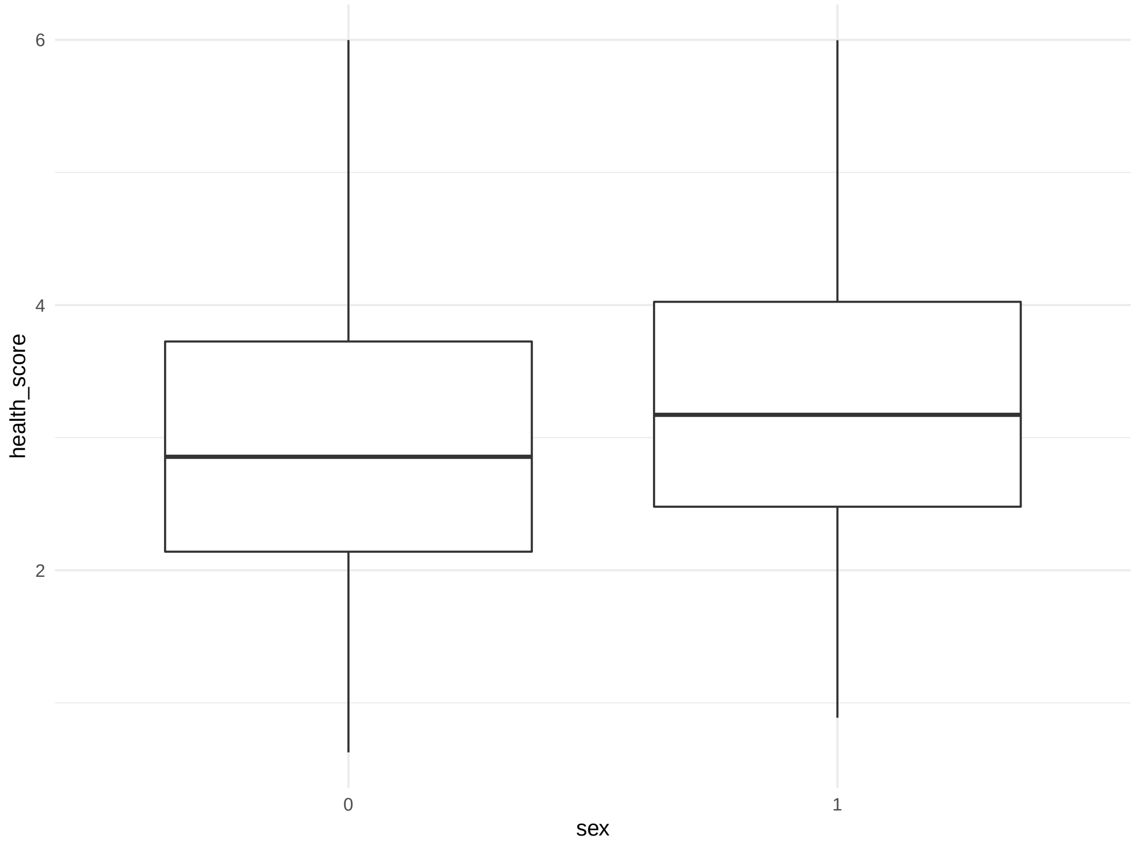
```
k = j %>%
  ggplot(aes(x = quarter, y = freq, fill = race)) + geom_bar(stat = "identity") +
  theme_classic() + scale_fill_manual(values = c("dodgerblue4","skyblue","pink")) + scale_x_discrete(nam
  scale_y_continuous(name = "Percentage",
                          breaks = seq(0, 100, 10),
                          limits = c(0, 100)) + labs(x = "Quarter", y = "Percentage" , title = "Distrib
k
```



```
practice_data %>%
  filter(
    health_score <= 6
  ) %>%
  ggplot(
    aes(x = health_score, y = salary)
  ) + geom_point(aes(color = "yellow")) + labs(
    x = "Heath Score", y = "Salary", title = "Association between Salary and Health Score"
  ) + scale_x_discrete(name = "Quarter", limits = c("1","2","3","4","5","6","7","8","9","10","11","12")
```



```
practice_data %>%
  drop_na() %>%
  filter(
    health_score <= 6
  ) %>%
  mutate(
    sex = factor(sex)
  ) %>%
  ggplot(
    aes(
      x = sex, y = health_score
    )
  ) + geom_boxplot()
```



```
t.test(health_score ~ factor(sex), data = new_data)
```

```
##
##  Welch Two Sample t-test
##
## data:  health_score by factor(sex)
## t = -17.726, df = 15816, p-value < 2.2e-16
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -0.3343974 -0.2678069
## sample estimates:
## mean in group 0 mean in group 1
##        2.995977        3.297079
```

```
t.test(health_score ~ hospital_visit, data = new_data)
```

```
##
##  Welch Two Sample t-test
##
## data:  health_score by hospital_visit
## t = -26.924, df = 2278.4, p-value < 2.2e-16
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -0.7129211 -0.6161208
## sample estimates:
```

```
## mean in group 0 mean in group 1
##        3.076413        3.740934
```