

Healthcare Worker Visit Analysis

```
options(warn = -1)
suppressPackageStartupMessages(library(dplyr))
suppressPackageStartupMessages(library(ggplot2))
```

Healthcare Worker Visit Analysis

This document provides analysis of the visit rates and behaviors of health care worker agents (HCWs) in the simulation. All results and visualizations related to HCW visits will be presented here.

```
library(dplyr)

df1 <- read.table("visit_data.txt", header = TRUE, sep = ",", stringsAsFactors = FALSE)
df2 <- df1[df1$patientLocation == 'ICU', ]

df2$visitDay <- floor(df2$visitTime)

# Remove first 90 visitTime values
df2_filtered <- df2 %>% arrange(visitTime) %>% slice(-(1:90))

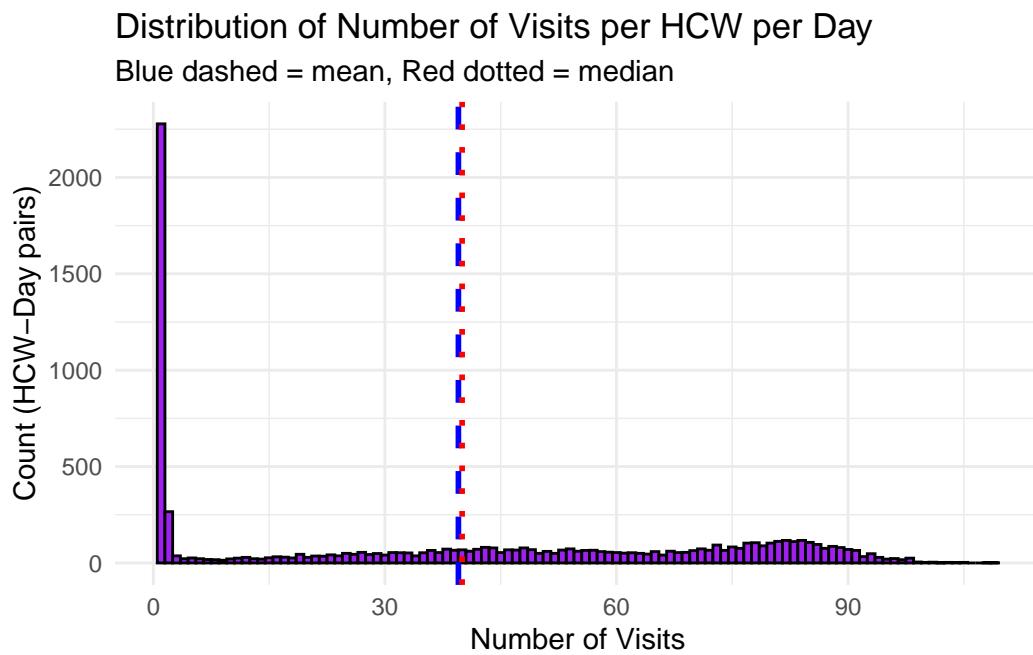
# Histogram: for each hcwId, each day, distribution of number of visits
visits_per_day <- df2_filtered %>% group_by(hcwId, visitDay) %>% summarise(n_visits = n())

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

```

library(ggplot2)
ggplot(visits_per_day, aes(x = n_visits)) +
  geom_histogram(binwidth = 1, fill = "purple", color = "black") +
  geom_vline(aes(xintercept = mean(visits_per_day$n_visits)), color = "blue", linetype = "dashed") +
  geom_vline(aes(xintercept = median(visits_per_day$n_visits)), color = "red", linetype = "dotted") +
  labs(title = "Distribution of Number of Visits per HCW per Day",
       x = "Number of Visits",
       y = "Count (HCW-Day pairs)",
       subtitle = "Blue dashed = mean, Red dotted = median") +
  theme_minimal()

```



```

# Text output for min, max, IQR
min_visits <- min(visits_per_day$n_visits)
max_visits <- max(visits_per_day$n_visits)
iqr_visits <- IQR(visits_per_day$n_visits)
cat("Min visits per HCW per day:", min_visits, "\n")

```

Min visits per HCW per day: 1

```
cat("Max visits per HCW per day:", max_visits, "\n")
```

Max visits per HCW per day: 109

```
cat("Interquartile range (IQR):", iqr_visits, "\n")
```

Interquartile range (IQR): 71

```
nvisits <- nrow(df2)

# Filter for nurse visits
df_nurse_visits <- df2[df2$hcwType == 'NURSE', ]
df_nurses <- distinct(df_nurse_visits, hcwType, hcwId)
nurse_count <- nrow(df_nurses)

# Filter for other HCW types
df_doctor_visits <- df2[df2$hcwType == 'DOCTOR', ]
df_doctors <- distinct(df_doctor_visits, hcwType, hcwId)
doctor_count <- nrow(df_doctors)

df_pt_visits <- df2[df2$hcwType == 'PT', ]
df_pts <- distinct(df_pt_visits, hcwType, hcwId)
pt_count <- nrow(df_pts)

df_ot_visits <- df2[df2$hcwType == 'OT', ]
df_ots <- distinct(df_ot_visits, hcwType, hcwId)
ot_count <- nrow(df_ots)

df_rt_visits <- df2[df2$hcwType == 'RT', ]
df_rts <- distinct(df_rt_visits, hcwType, hcwId)
rt_count <- nrow(df_rts)
```

Total patient visits by hcw type

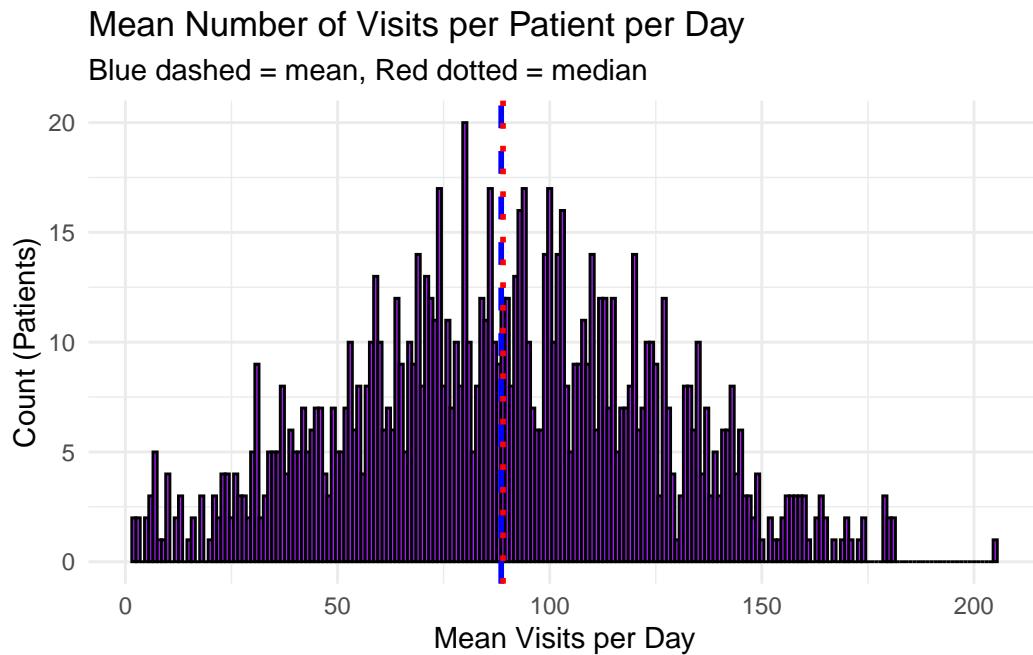
HCW Type	Total visits (365d)	mean/day
NURSE (10)	240399	65.8627397
DOCTOR (6)	70906	32.3771689
OT (12)	1277	0.2915525
PT (12)	988	0.2255708
RT (12)	598	0.1365297

Histogram: Mean Number of Visits per Patient per Day

```
# Calculate mean number of visits per patientId per day
visits_per_patient_day <- df2_filtered %>% group_by(patientId, visitDay) %>% summarise(n_visits = n(), mean_visits = mean(n_visits), median_visits = median(n_visits))

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

mean_visits <- visits_per_patient_day %>% group_by(patientId) %>% summarise(mean_visits = mean_visits,
  ggplot(mean_visits, aes(x = mean_visits)) +
    geom_histogram(binwidth = 1, fill = "purple", color = "black") +
    geom_vline(xintercept = mean(mean_visits$mean_visits), color = "blue", linetype = "dashed") +
    geom_vline(xintercept = median(mean_visits$mean_visits), color = "red", linetype = "dotted")
  labs(title = "Mean Number of Visits per Patient per Day",
    x = "Mean Visits per Day",
    y = "Count (Patients)",
    subtitle = "Blue dashed = mean, Red dotted = median") +
  theme_minimal()
```



```
min_mean_visits <- min(mean_visits$mean_visits)
max_mean_visits <- max(mean_visits$mean_visits)
```

```
mean_mean_visits <- mean(mean_visits$mean_visits)
median_mean_visits <- median(mean_visits$mean_visits)
cat("Min visits per patient per day:", min_mean_visits, "\n")
```

Min visits per patient per day: 2

```
cat("Max visits per patient per day:", max_mean_visits, "\n")
```

Max visits per patient per day: 205.5

```
cat("Mean visits per patient per day:", mean_mean_visits, "\n")
```

Mean visits per patient per day: 88.57229

```
cat("Median visits per patient per day:", median_mean_visits, "\n")
```

Median visits per patient per day: 89

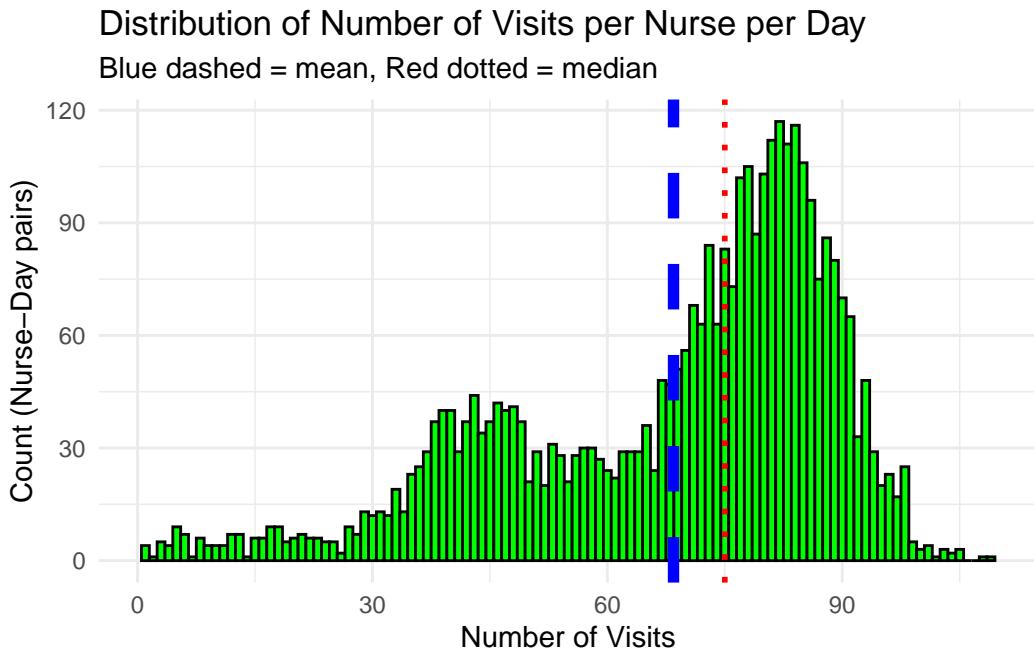
Visits per HCW per Day by Type

Distribution of Number of Visits per Nurse per Day

```
visits_per_nurse_day <- df_nurse_visits %>% group_by(hcwId, visitDay) %>% summarise(n_visits =
```

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

```
ggplot(visits_per_nurse_day, aes(x = n_visits)) +
  geom_histogram(binwidth = 1, fill = "green", color = "black") +
  geom_vline(aes(xintercept = mean(visits_per_nurse_day$n_visits)), color = "blue", linetype = "dashed") +
  geom_vline(aes(xintercept = median(visits_per_nurse_day$n_visits)), color = "red", linetype = "dotted") +
  labs(title = "Distribution of Number of Visits per Nurse per Day",
       x = "Number of Visits",
       y = "Count (Nurse-Day pairs)",
       subtitle = "Blue dashed = mean, Red dotted = median") +
  theme_minimal()
```



```
min_nurse_visits <- min(visits_per_nurse_day$n_visits)
max_nurse_visits <- max(visits_per_nurse_day$n_visits)
mean_nurse_visits <- mean(visits_per_nurse_day$n_visits)
median_nurse_visits <- median(visits_per_nurse_day$n_visits)
```

Min visits per nurse per day: 1
 Max visits per nurse per day: 109
 Mean visits per nurse per day: 68.4507403
 Median visits per nurse per day: 75

Distribution of Number of Visits per Doctor per Day

```
visits_per_doctor_day <- df_doctor_visits %>% group_by(hcwid, visitDay) %>% summarise(n_visits = sum(n_visits))

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

ggplot(visits_per_doctor_day, aes(x = n_visits)) +
  geom_histogram(binwidth = 1, fill = "orange", color = "black") +
  geom_vline(aes(xintercept = mean(visits_per_doctor_day$n_visits)), color = "blue", linetype = "dashed")
```

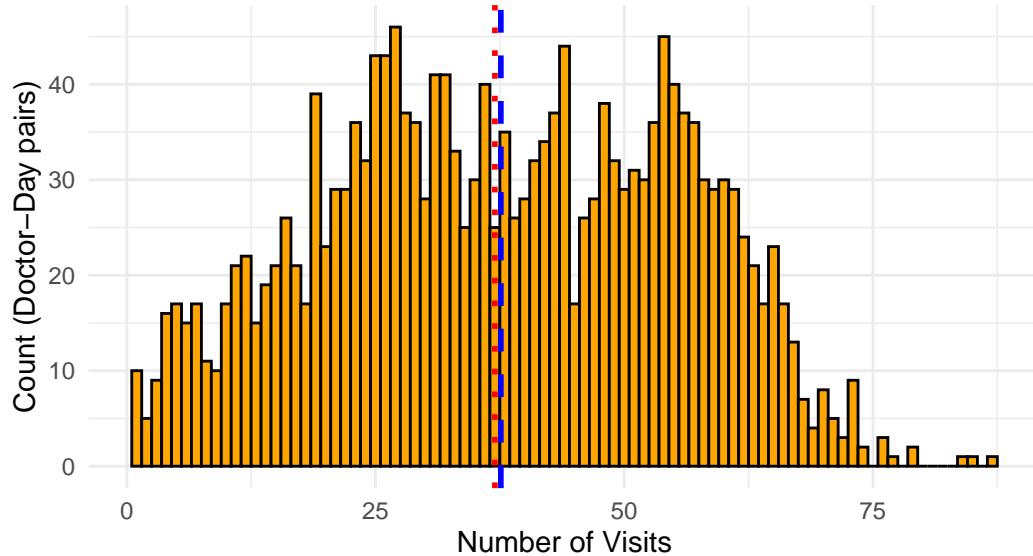
```

geom_vline(aes(xintercept = median(visits_per_doctor_day$n_visits)), color = "red", line
labs(title = "Distribution of Number of Visits per Doctor per Day",
      x = "Number of Visits",
      y = "Count (Doctor-Day pairs)",
      subtitle = "Blue dashed = mean, Red dotted = median") +
theme_minimal()

```

Distribution of Number of Visits per Doctor per Day

Blue dashed = mean, Red dotted = median



```

min_doctor_visits <- min(visits_per_doctor_day$n_visits)
max_doctor_visits <- max(visits_per_doctor_day$n_visits)
mean_doctor_visits <- mean(visits_per_doctor_day$n_visits)
median_doctor_visits <- median(visits_per_doctor_day$n_visits)

```

Min visits per doctor per day: 1
 Max visits per doctor per day: 87
 Mean visits per doctor per day: 37.5959703
 Median visits per doctor per day: 37

Distribution of Number of Visits per PT per Day

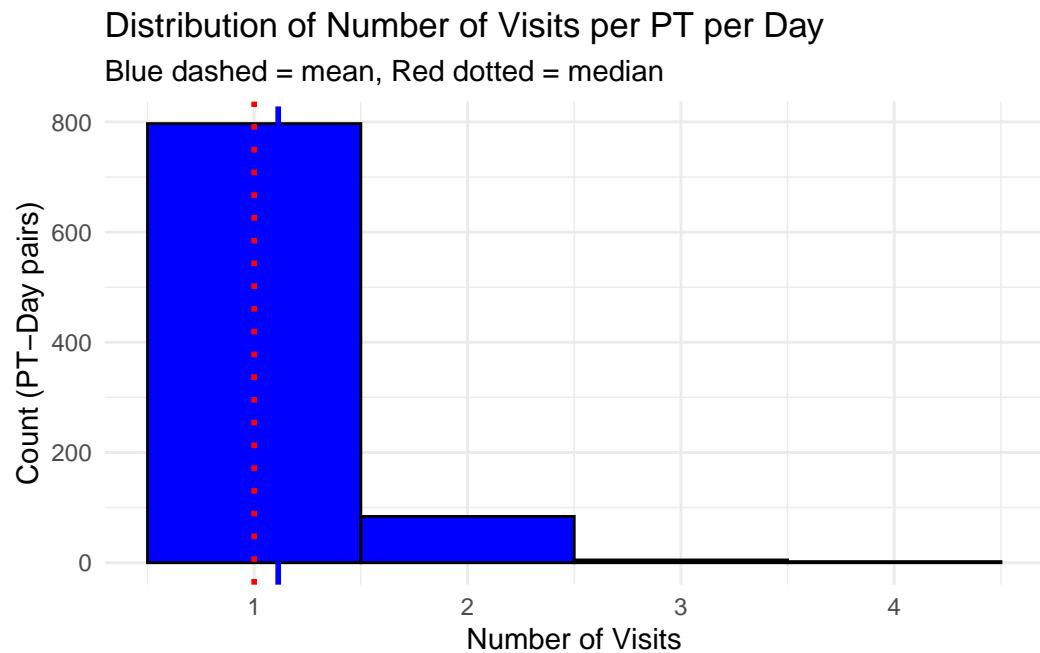
```

visits_per_pt_day <- df_pt_visits %>% group_by(hcwId, visitDay) %>% summarise(n_visits = n())

```

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

```
ggplot(visits_per_pt_day, aes(x = n_visits)) +  
  geom_histogram(binwidth = 1, fill = "blue", color = "black") +  
  geom_vline(aes(xintercept = mean(visits_per_pt_day$n_visits)), color = "blue", linetype = "dashed") +  
  geom_vline(aes(xintercept = median(visits_per_pt_day$n_visits)), color = "red", linetype = "dotted") +  
  labs(title = "Distribution of Number of Visits per PT per Day",  
       x = "Number of Visits",  
       y = "Count (PT-Day pairs)",  
       subtitle = "Blue dashed = mean, Red dotted = median") +  
  theme_minimal()
```



```
min_pt_visits <- min(visits_per_pt_day$n_visits)  
max_pt_visits <- max(visits_per_pt_day$n_visits)  
mean_pt_visits <- mean(visits_per_pt_day$n_visits)  
median_pt_visits <- median(visits_per_pt_day$n_visits)
```

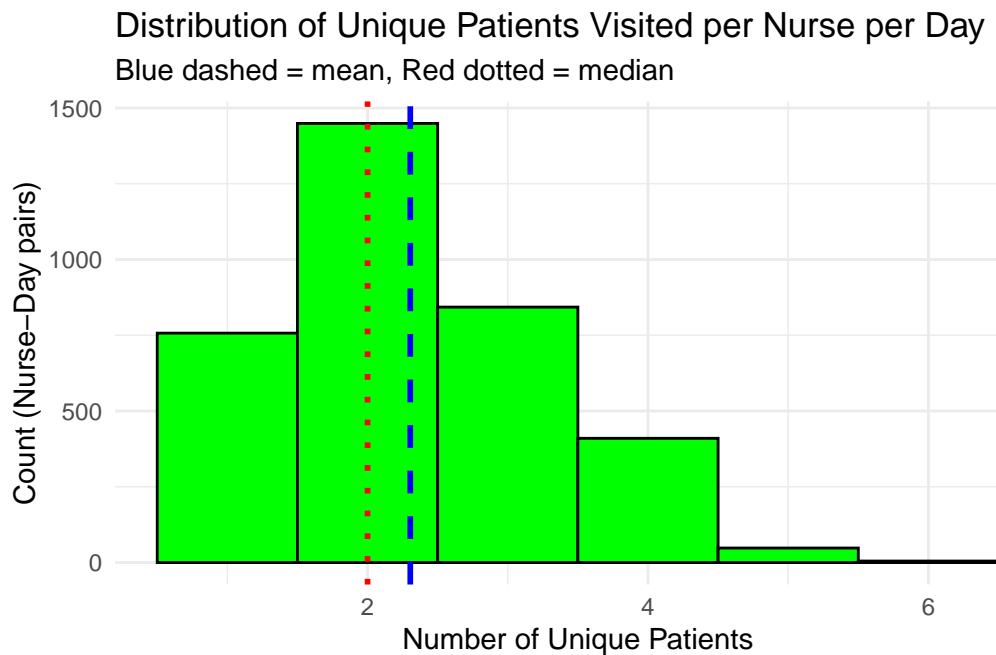
Min visits per PT per day: 1
Max visits per PT per day: 4
Mean visits per PT per day: 1.1126126
Median visits per PT per day: 1

Distribution of Number of Unique Patients Visited per Day by HCW Type

Nurses

```
unique_patients_per_nurse_day <- df_nurse_visits %>% group_by(hcwId, visitDay) %>% summarise  
`summarise()` has grouped output by 'hcwId'. You can override using the  
.groups` argument.
```

```
ggplot(unique_patients_per_nurse_day, aes(x = n_unique_patients)) +  
  geom_histogram(binwidth = 1, fill = "green", color = "black") +  
  geom_vline(aes(xintercept = mean(n_unique_patients)), color = "blue", linetype = "dashed") +  
  geom_vline(aes(xintercept = median(n_unique_patients)), color = "red", linetype = "dotted") +  
  labs(title = "Distribution of Unique Patients Visited per Nurse per Day",  
       x = "Number of Unique Patients",  
       y = "Count (Nurse-Day pairs)",  
       subtitle = "Blue dashed = mean, Red dotted = median") +  
  theme_minimal()
```



```
min_nurse_patients <- min(unique_patients_per_nurse_day$n_unique_patients)
max_nurse_patients <- max(unique_patients_per_nurse_day$n_unique_patients)
mean_nurse_patients <- mean(unique_patients_per_nurse_day$n_unique_patients)
median_nurse_patients <- median(unique_patients_per_nurse_day$n_unique_patients)
```

Min unique patients per Nurse per day: 1
Max unique patients per Nurse per day: 6
Mean unique patients per Nurse per day: 2.3046697
Median unique patients per Nurse per day: 2

Unique Patients visited per day

Doctors

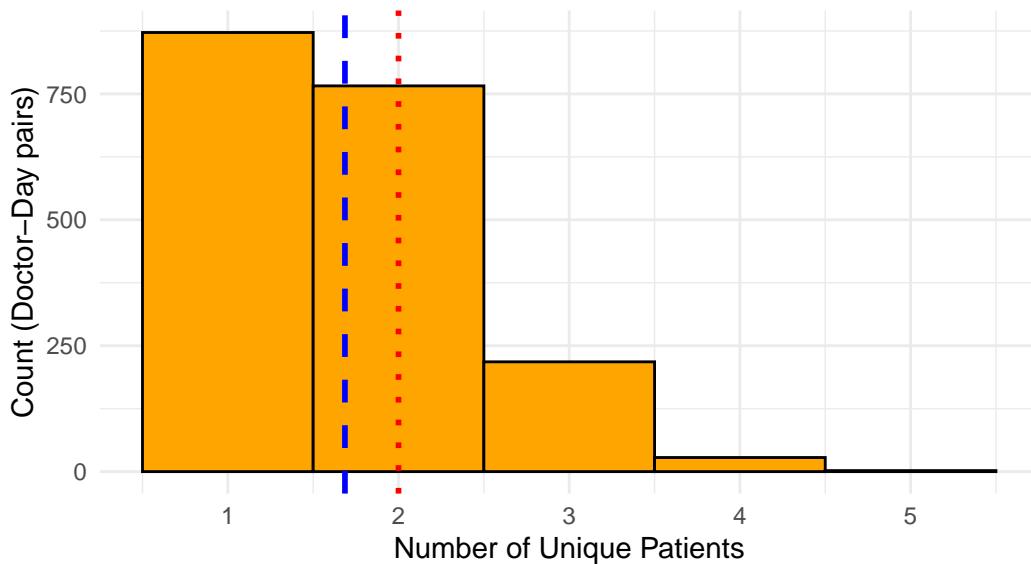
```
unique_patients_per_doctor_day <- df_doctor_visits %>% group_by(hcwId, visitDay) %>% summarise()
```

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

```
ggplot(unique_patients_per_doctor_day, aes(x = n_unique_patients)) +
  geom_histogram(binwidth = 1, fill = "orange", color = "black") +
  geom_vline(aes(xintercept = mean(n_unique_patients)), color = "blue", linetype = "dashed") +
  geom_vline(aes(xintercept = median(n_unique_patients)), color = "red", linetype = "dotted") +
  labs(title = "Distribution of Unique Patients Visited per Doctor per Day",
       x = "Number of Unique Patients",
       y = "Count (Doctor-Day pairs)",
       subtitle = "Blue dashed = mean, Red dotted = median") +
  theme_minimal()
```

Distribution of Unique Patients Visited per Doctor per Day

Blue dashed = mean, Red dotted = median



```
min_doctor_patients <- min(unique_patients_per_doctor_day$n_unique_patients)
max_doctor_patients <- max(unique_patients_per_doctor_day$n_unique_patients)
mean_doctor_patients <- mean(unique_patients_per_doctor_day$n_unique_patients)
median_doctor_patients <- median(unique_patients_per_doctor_day$n_unique_patients)
```

Min unique patients per Doctor per day: 1

Max unique patients per Doctor per day: 5

Mean unique patients per Doctor per day: 1.6861082

Median unique patients per Doctor per day: 2

Distribution of Number of Unique Healthcare Providers Seen by a Patient per Day

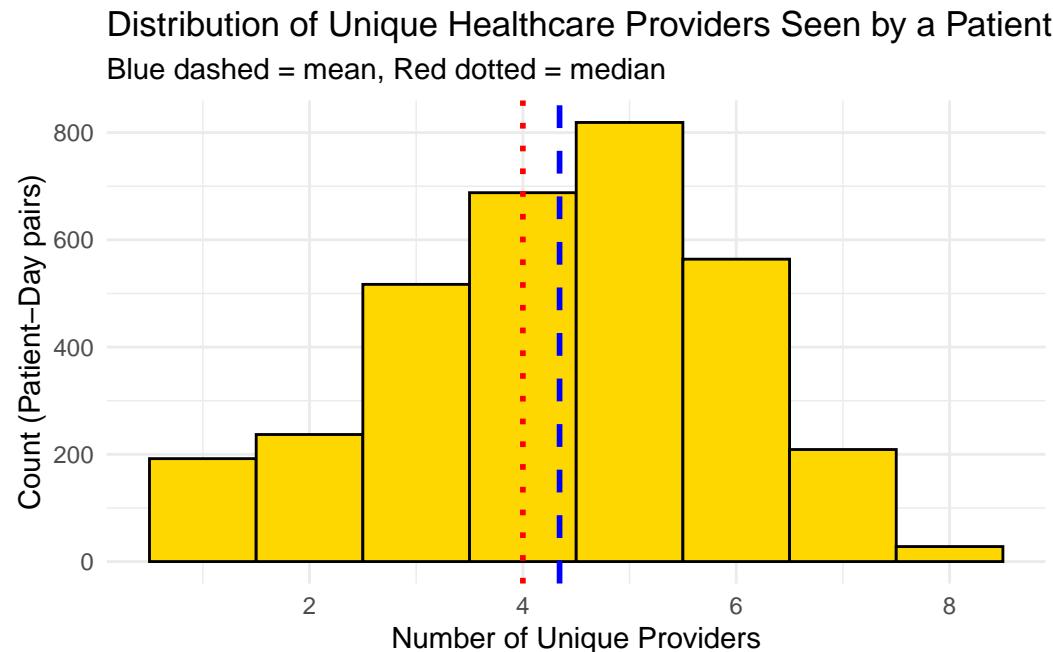
```
unique_providers_per_patient_day <- df2_filtered %>% group_by(patientId, visitDay) %>% summarise()
```

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

```

ggplot(unique_providers_per_patient_day, aes(x = n_unique_providers)) +
  geom_histogram(binwidth = 1, fill = "gold", color = "black") +
  geom_vline(aes(xintercept = mean(n_unique_providers)), color = "blue", linetype = "dashed")
  geom_vline(aes(xintercept = median(n_unique_providers)), color = "red", linetype = "dotted")
  labs(title = "Distribution of Unique Healthcare Providers Seen by a Patient per Day",
       x = "Number of Unique Providers",
       y = "Count (Patient-Day pairs)",
       subtitle = "Blue dashed = mean, Red dotted = median") +
  theme_minimal()

```



```

min_patient_providers <- min(unique_providers_per_patient_day$n_unique_providers)
max_patient_providers <- max(unique_providers_per_patient_day$n_unique_providers)
mean_patient_providers <- mean(unique_providers_per_patient_day$n_unique_providers)
median_patient_providers <- median(unique_providers_per_patient_day$n_unique_providers)

```

Min unique providers per patient per day: 1
 Max unique providers per patient per day: 8
 Mean unique providers per patient per day: 4.3438844
 Median unique providers per patient per day: 4