

GROUP – 10  
Data-Driven Insights into Employee Attrition, Salaries, and Performance  
Ratings

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# INTRODUCTION

- In the dynamic realm of organizational management, the interconnected factors of employee attrition, salaries, and performance ratings are pivotal for the success and longevity of enterprises.
- Understanding the intricate dynamics is essential for fostering a thriving work environment. Job satisfaction stands out as a cornerstone for both employee retention and heightened performance, emphasizing the significance of individuals finding purpose in their roles (Zhenjing et al., 2022, pp. 1,2).
- The delicate balance of work-life equilibrium, including flexible schedules and supportive policies, plays a crucial role in ensuring employee well-being and sustained commitment (Alblihed & Alzghabi, 2022, p. 2).
- Competitive and fair compensation structures are foundational, with perceived commensurability driving employee retention (Balushi et al., 2022, p. 2).

# RQ & Hypothesis

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- **Multiple linear regression**

What factors significantly determine employee salaries in the company, and how well can we predict salaries using variables like years of experience, education level, job level, and department?

- **Null Hypothesis (H0):** There is no significant relationship between employee salaries and variables such as years of experience, education level, job level, and department.
- **Alternative Hypothesis (H1):** There is a significant relationship between employee salaries and variables such as years of experience, education level, job level, and department, allowing us to predict salaries effectively.

- **Logistic Regression**

How do demographic and job-related factors (age, gender, job level, department, job satisfaction) collectively impact employee attrition, and can we build an accurate predictive model for it?

- **Null Hypothesis (H0):** There is no significant relationship between demographics, job-related factors (age, gender, job level, department, job satisfaction) and employee attrition within the company.
- **Alternative Hypothesis (H1):** There is a significant relationship between demographics, job-related factors (age, gender, job level, department, job satisfaction) and employee attrition within the company.

# RQ & Hypothesis

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- **Ordinary regression analysis**

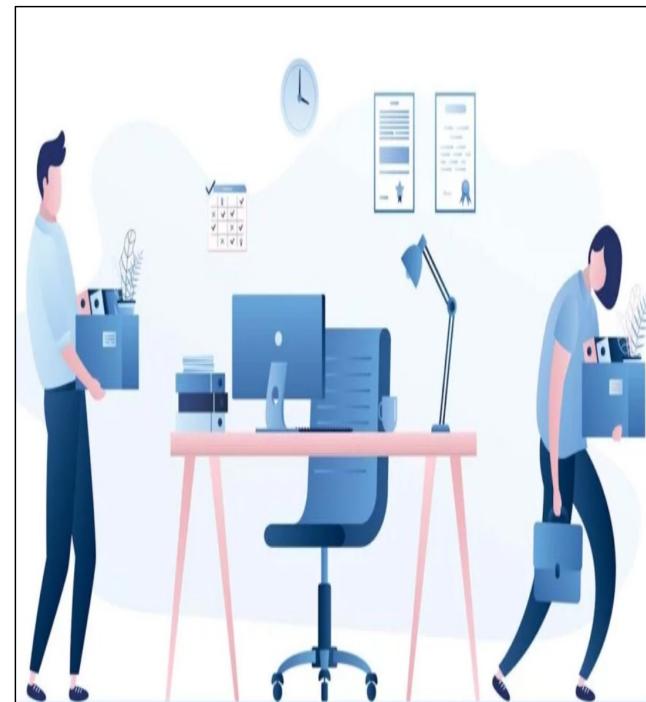
How do factors like environment satisfaction, job satisfaction, relationship satisfaction, and work-life balance affect the likelihood of achieving higher performance ratings, and can we create an accurate predictive model for performance ratings?

- **Null Hypotheses (H0):** There is no significant relationship between environment satisfaction, job satisfaction, relationship satisfaction, work-life balance, and performance ratings.
- **Alternative Hypotheses (H1):** There is a significant relationship between at least one of the factors (environment satisfaction, job satisfaction, relationship satisfaction, work-life balance) and performance ratings.

# Dataset

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- The analysis is based on employee attrition in a corporate setting, where various factors affecting employee turnover are explored.
- The dataset, sourced from Kaggle's Employee Attrition dataset by Prashant Patel, consists of 1470 observations and 28 variables.
- The dataset enables an in-depth exploration of factors influencing employee attrition, with variables covering personal demographics, job-related information, and overall job satisfaction. The analysis seeks to uncover patterns and insights into why employees may leave an organization, considering a wide range of factors.



# Variables

Categorical Variables		Numerical Variables	
Ordinal	Nominal	Continuous	Discrete
Education EnvironmentSatisfaction JobInvolvement JobSatisfaction PerformanceRating RelationshipSatisfaction WorkLifeBalance	Attrition BusinessTravel Department EducationField Gender JobRole MaritalStatus Over18 OverTime	Age MonthlyIncome	DistanceFromHome Education EnvironmentSatisfaction JobInvolvement JobLevel JobSatisfaction NumCompaniesWorked PercentSalaryHike PerformanceRating RelationshipSatisfaction TotalWorkingYears TrainingTimesLastYear WorkLifeBalance YearsAtCompany YearsInCurrentRole YearsSinceLastPromotion YearsWithCurrManager

# Data Importing

---

- The CSV file containing employee attrition data was uploaded to R using the "read.csv" code.

```
```{r}
data <- read.csv("HR-Employee-Attrition.csv")
````
```

- Following the dataset upload, we opted to eliminate unnecessary columns based on our objectives, accomplishing this task with the assistance of:

```
```{r}
columns_to_remove <- c("DailyRate", "EmployeeNumber", "HourlyRate", "MonthlyRate", "StandardHours", "StockOptionLevel",
"EmployeeCount")

data <- data[, !(names(data) %in% columns_to_remove)]
````
```

# Data Description

- We examined the first few rows of the modified dataset with the command "head(data)" and obtained a summary of the dataset using "summary(data)."

```
```{r}  
head(data)  
summary(data)|  
```
```

| Age   | Attrition | BusinessTravel | Department        | DistanceFromHome       | Education | EducationField  |
|-------|-----------|----------------|-------------------|------------------------|-----------|-----------------|
| <int> | <chr>     | <chr>          | <chr>             | <int>                  | <int>     | <chr>           |
| 1     | 41        | Yes            | Travel_Rarely     | Sales                  | 1         | 2 Life Sciences |
| 2     | 49        | No             | Travel_Frequently | Research & Development | 8         | 1 Life Sciences |
| 3     | 37        | Yes            | Travel_Rarely     | Research & Development | 2         | 2 Other         |
| 4     | 33        | No             | Travel_Frequently | Research & Development | 3         | 4 Life Sciences |
| 5     | 27        | No             | Travel_Rarely     | Research & Development | 2         | 1 Medical       |
| 6     | 32        | No             | Travel_Frequently | Research & Development | 2         | 2 Life Sciences |

```
:character  
Mean :2.729          Mean  : 6503  Mean   :2.693  
3rd Qu.:4.000         3rd Qu.: 8379  3rd Qu.:4.000  
Max.  :4.000          Max.  :19999  Max.   :9.000  
PercentSalaryHike PerformanceRating RelationshipSatisfaction TotalWorkingYears  
TrainingTimesLastYear WorkLifeBalance  
Min.   :11.00          Min.  :3.000  Min.   :1.000      Min.   : 0.00  Min.   :0.000  
Min.   :1.000          1st Qu.:3.000  1st Qu.:2.000      1st Qu.: 6.00  1st Qu.:2.000  
1st Qu.:12.00          Median :3.000  Median :3.000      Median :10.00  Median :3.000  
1st Qu.:2.000          Mean   :3.154  Mean   :2.712      Mean   :11.28  Mean   :2.799  
Median :14.00          Mean   :2.761  Mean   :2.188      Mean   :11.23  Mean   :2.799  
Median :3.000          3rd Qu.:18.00  3rd Qu.:4.000      3rd Qu.:15.00  3rd Qu.:3.000  
Mean   :15.21          3rd Qu.:3.000  3rd Qu.:3.000      Median :10.00  Median :3.000  
Mean   :2.761          Max.   :4.000  Max.   :4.000      Max.   :40.00  Max.   :6.000  
3rd Qu.:18.00          Max.   :4.000  Max.   :4.000      Max.   :40.00  Max.   :6.000  
3rd Qu.:3.000          Max.   :4.000  Max.   :4.000      Max.   :40.00  Max.   :6.000  
Max.   :4.000          YearsAtCompany  YearsInCurrentRole  YearsSinceLastPromotion  YearsWithCurrManager  
YearsAtCompany  YearsInCurrentRole  YearsSinceLastPromotion  YearsWithCurrManager  
Min.   : 0.000          Min.  : 0.000  Min.   : 0.000      Min.   : 0.000  
1st Qu.: 3.000          1st Qu.: 2.000  1st Qu.: 0.000      1st Qu.: 2.000  
Median : 5.000          Median : 3.000  Median : 1.000      Median : 3.000  
Mean   : 7.008          Mean   : 4.229  Mean   : 2.188      Mean   : 4.123  
3rd Qu.: 9.000          3rd Qu.: 7.000  3rd Qu.: 3.000      3rd Qu.: 7.000  
Max.   :40.000          Max.  :18.000  Max.   :15.000      Max.   :17.000
```

# Data Description

---

- We explored the dimensions of the dataset using "dim(data)," revealing the number of rows and columns. Additionally, we examined the structure of the dataset with "str(data)," obtaining information about the variable types and their respective attributes.

```
```{r}
dim(data)
str(data)
```
```

```
'data.frame': 1470 obs. of 28 variables:
 $ Age           : int 41 49 37 33 27 32 59 30 38 36 ...
 $ Attrition     : chr "Yes" "No" "Yes" "No" ...
 $ BusinessTravel: chr "Travel_Rarely" "Travel_Frequently" "Travel_Rarely" "Travel_Frequently" ...
 $ Department    : chr "Sales" "Research & Development" "Research & Development" "Research & Development" ...
 $ DistanceFromHome: int 1 8 2 3 2 2 3 24 23 27 ...
 $ Education      : int 2 1 2 4 1 2 3 1 3 3 ...
 $ EducationField : chr "Life Sciences" "Life Sciences" "Other" "Life Sciences" ...
 $ EnvironmentSatisfaction: int 2 3 4 4 1 4 3 4 4 3 ...
 $ Gender         : chr "Female" "Male" "Male" "Female" ...
 $ JobInvolvement: int 3 2 2 3 3 3 4 3 2 3 ...
 $ JobLevel       : int 2 2 1 1 1 1 1 1 3 2 ...
 $ JobRole        : chr "Sales Executive" "Research Scientist" "Laboratory Technician" "Research Scientist" ...
 $ JobSatisfaction: int 4 2 3 3 2 4 1 3 3 3 ...
 $ MaritalStatus  : chr "Single" "Married" "Single" "Married" ...
 $ MonthlyIncome  : int 5993 5130 2090 2090 3468 3068 2670 2693 9526 5237 ...
 $ NumCompaniesWorked: int 8 1 6 1 9 0 4 1 0 6 ...
 $ Over18         : chr "Y" "Y" "Y" "Y" ...
 $ Overtime       : chr "Yes" "No" "Yes" "Yes" ...
 $ PercentSalaryHike: int 11 23 15 11 12 13 20 22 21 13 ...
 $ PerformanceRating: int 3 4 3 3 3 3 4 4 4 3 ...
 $ RelationshipSatisfaction: int 1 4 2 3 4 3 1 2 2 2 ...
 $ TotalWorkingYears: int 8 10 7 8 6 8 12 1 10 17 ...
 $ TrainingTimesLastYear: int 0 3 3 3 3 2 3 2 2 3 ...
 $ WorklifeBalance: int 1 3 3 3 3 2 2 3 3 2 ...
 $ YearsAtCompany: int 6 10 0 8 2 7 1 1 9 7 ...
 $ YearsInCurrentRole: int 4 7 0 7 2 7 0 0 7 7 ...
 $ YearsSinceLastPromotion: int 0 1 0 3 2 3 0 0 1 7 ...
 $ YearsWithCurrManager: int 5 7 0 0 2 6 0 0 8 7 ...
```

# Data Cleaning

---

- We examined the dataset for null values, and the findings reveal an absence of any null entries in our data.

```
```{r}
# Checking for NA values in the entire data frame
if (any(is.na(data))) {
  print("There are NA values in the data frame.")
} else {
  print("There are no NA values in the data frame.")
}
```
[1] "There are no NA values in the data frame."
```

- We conducted a search for duplicate values in our dataset and determined that there were none present.

```
```{r}
any(duplicated(data))
```
[1] FALSE
```

# Data Cleaning

---

- The subsequent step involves examining for outliers. We conducted an inspection for outliers using the Interquartile Range (IQR) method.

```
```{r}
# Function to detect outliers using IQR method
detect_outliers <- function(variable) {
  Q1 <- quantile(variable, 0.25)
  Q3 <- quantile(variable, 0.75)
  IQR <- Q3 - Q1

  # Identify potential outliers
  potential_outliers <- variable < (Q1 - 1.5 * IQR) | variable > (Q3 + 1.5 * IQR)

  return(potential_outliers)
}

# Columns to check for outliers
columns_to_check <- c(
  "DistanceFromHome",
  "MonthlyIncome",
  "NumCompaniesWorked",
  "PercentSalaryHike",
  "TotalWorkingYears",
  "YearsAtCompany",
  "YearsInCurrentRole",
  "YearsSinceLastPromotion",
  "YearsWithCurrManager"
)

# Check for outliers in each column
for (col in columns_to_check) {
  variable <- data[[col]]
  outliers <- detect_outliers(variable)
  print(paste("Outliers in", col, ":", any(outliers)))
}
```

```

```
[1] "Outliers in DistanceFromHome : FALSE"
[1] "Outliers in MonthlyIncome : TRUE"
[1] "Outliers in NumCompaniesWorked : TRUE"
[1] "Outliers in PercentSalaryHike : FALSE"
[1] "Outliers in TotalWorkingYears : TRUE"
[1] "Outliers in YearsAtCompany : TRUE"
[1] "Outliers in YearsInCurrentRole : TRUE"
[1] "Outliers in YearsSinceLastPromotion : TRUE"
[1] "Outliers in YearsWithCurrManager : TRUE"
```

# Data Cleaning

---

We opted to address outliers in the dataset through the application of the Winsorization technique, employing the clipping method.

```
```{r}
# Function to clip (cap) outliers based on IQR method
clip_outliers <- function(variable) {
  Q1 <- quantile(variable, 0.25)
  Q3 <- quantile(variable, 0.75)
  IQR <- Q3 - Q1

  # Set the clipping threshold
  threshold <- 1.5

  # Clip (cap) values beyond the threshold
  variable[variable < (Q1 - threshold * IQR)] <- (Q1 - threshold * IQR)
  variable[variable > (Q3 + threshold * IQR)] <- (Q3 + threshold * IQR)

  return(variable)
}

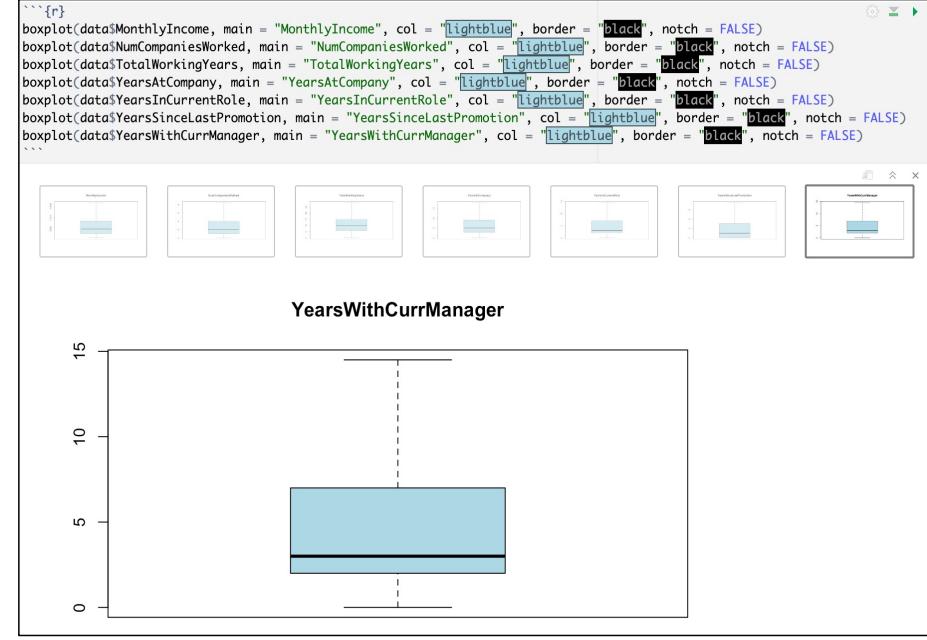
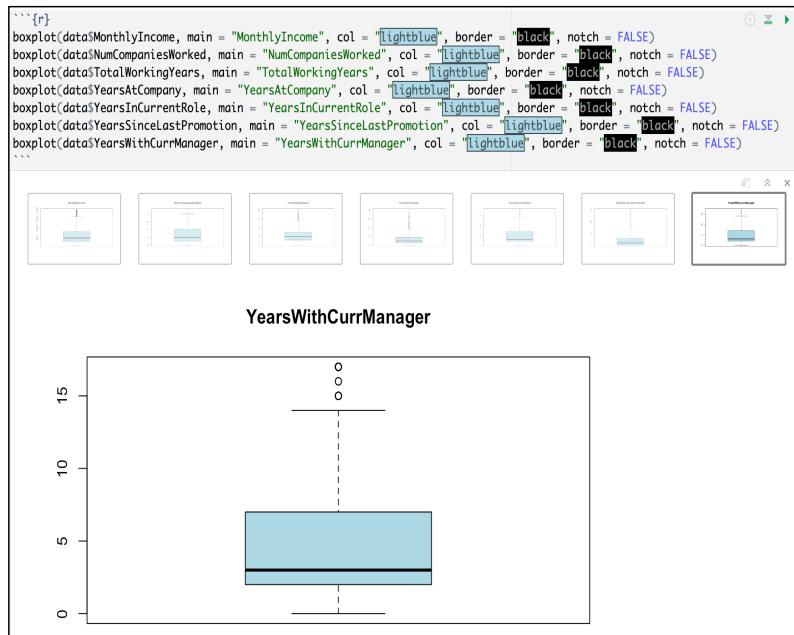
# Columns to clip (cap) outliers
columns_to_clip <- c(
  "DistanceFromHome",
  "MonthlyIncome",
  "NumCompaniesWorked",
  "PercentSalaryHike",
  "TotalWorkingYears",
  "YearsAtCompany",
  "YearsInCurrentRole",
  "YearsSinceLastPromotion",
  "YearsWithCurrManager"
)

# Clip (cap) outliers in each column
for (col in columns_to_clip) {
  variable <- data[[col]]
  data[[col]] <- clip_outliers(variable)
}
```

```

# Data Cleaning

We employed a box plot to illustrate the presence of outliers. Subsequently, we utilized the interquartile range to eliminate these outliers, aiming to enhance the dataset's distribution and improve the model's performance.



# Exploratory Data Analysis

- **Summary statistics**
- We conducted a comprehensive analysis of summary statistics, delving into various metrics such as mean, median, and other relevant measures. This exploration provided a detailed insight into the central tendencies and distribution characteristics of the dataset.

```
```{r}
summary(data)
```

Age Attrition BusinessTravel Department DistanceFromHome Education
Min. :18.00 Length:1470 Length:1470 Length:1470 Min. : 1.000 Min. :1.000
1st Qu.:30.00 Class :character Class :character Class :character 1st Qu.: 2.000 1st Qu.:2.000
Median :36.00 Mode :character Mode :character Mode :character Median : 7.000 Median :3.000
Mean :36.92 Mean :36.92 Mean :36.92 Mean : 9.193 Mean :2.913
3rd Qu.:43.00 3rd Qu.:43.00 3rd Qu.:43.00 3rd Qu.:14.000 3rd Qu.:4.000
Max. :60.00 Max. :60.00 Max. :60.00 Max. :29.000 Max. :5.000

EducationField EnvironmentSatisfaction Gender JobInvolvement JobLevel JobRole
Length:1470 Min. :1.000 Length:1470 Min. :1.000 Min. :1.000 Length:1470
Class :character 1st Qu.:2.000 Class :character 1st Qu.:2.000 1st Qu.:1.000 Class :character
Mode :character Median :3.000 Mode :character Median :3.000 Median :2.000 Mode :character
Mean :2.722 Mean :2.722 Mean :2.73 Mean :2.064
3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.000 3rd Qu.:3.000
Max. :4.000 Max. :4.000 Max. :4.00 Max. :5.000

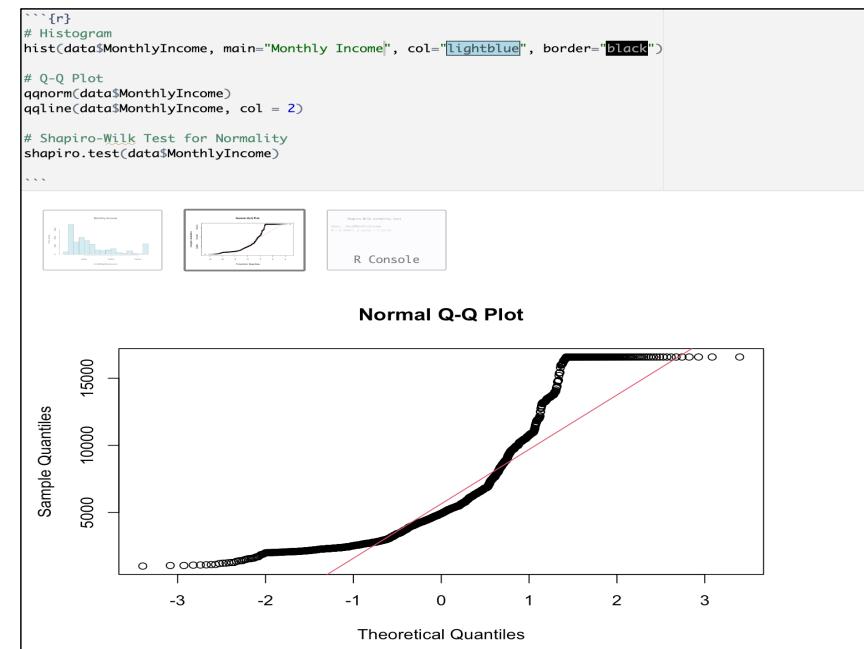
JobSatisfaction MaritalStatus MonthlyIncome NumCompaniesWorked Over18 Overtime
Min. :1.000 Length:1470 Min. : 1009 Min. : 0.000 Length:1470 Length:1470
1st Qu.:2.000 Class :character 1st Qu.: 2911 1st Qu.:1.000 Class :character Class :character
Median :3.000 Mode :character Median : 4919 Median : 2.000 Mode :character Mode :character
Mean :2.729 Mean :2.729 Mean : 6362 Mean :2.676
3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.: 8379 3rd Qu.:4.000
Max. :4.000 Max. :4.000 Max. :16581 Max. :8.500

PercentSalaryHike PerformanceRating RelationshipSatisfaction TotalWorkingYears TrainingTimesLastYear WorkLifeBalance
Min. :11.00 Min. :3.000 Min. :1.000 Min. : 0.0 Min. :0.000 Min. :1.000
1st Qu.:12.00 1st Qu.:3.000 1st Qu.:2.000 1st Qu.: 6.0 1st Qu.:2.000 1st Qu.:2.000
Median :14.00 Median :3.000 Median :3.000 Median :10.0 Median :3.000 Median :3.000
Mean :15.21 Mean :3.154 Mean :2.712 Mean :11.1 Mean :2.799 Mean :2.761
3rd Qu.:18.00 3rd Qu.:3.000 3rd Qu.:4.000 3rd Qu.:15.0 3rd Qu.:3.000 3rd Qu.:3.000
Max. :25.00 Max. :4.000 Max. :4.000 Max. :28.5 Max. :6.000 Max. :4.000

YearsAtCompany YearsInCurrentRole YearsSinceLastPromotion YearsWithCurrManager
Min. : 0.000 Min. : 0.000 Min. : 0.000 Min. : 0.000
1st Qu.: 3.000 1st Qu.: 2.000 1st Qu.:0.000 1st Qu.: 2.000
Median : 5.000 Median : 3.000 Median :1.000 Median : 3.000
Mean : 6.618 Mean : 4.208 Mean :1.923 Mean : 4.107
3rd Qu.: 9.000 3rd Qu.: 7.000 3rd Qu.:3.000 3rd Qu.: 7.000
Max. :18.000 Max. :14.500 Max. :7.500 Max. :14.500
```

# Checking for Normality

- We conducted a normality assessment using a combination of a histogram, Q-Q plot, and the Shapiro-Wilk test to evaluate the distribution characteristics of the data and ascertain whether it adheres to a normal distribution. This plots reveals that the monthly income variable does not follow normal distribution.

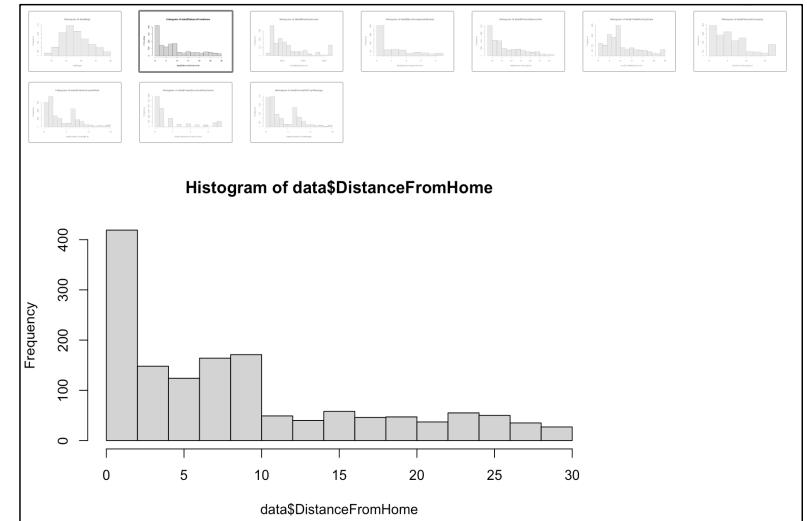


# Log Transformation

---

- Given that certain columns in the dataset do not exhibit a normal distribution, our intention is to execute a log transformation on these variables. This transformation aims to render the variables more closely aligned with a normal distribution.
- The histograms presented depict the before and after the log transformation of certain columns in the dataset.

```
```{r}
hist(data$Age)
hist(data$DistanceFromHome)
hist(data$MonthlyIncome)
hist(data$NumCompaniesWorked)
hist(data$PercentSalaryHike)
hist(data$TotalWorkingYears)
hist(data$YearsAtCompany)
hist(data$YearsInCurrentRole)
hist(data$YearsSinceLastPromotion)
hist(data$YearsWithCurrManager)
```
```



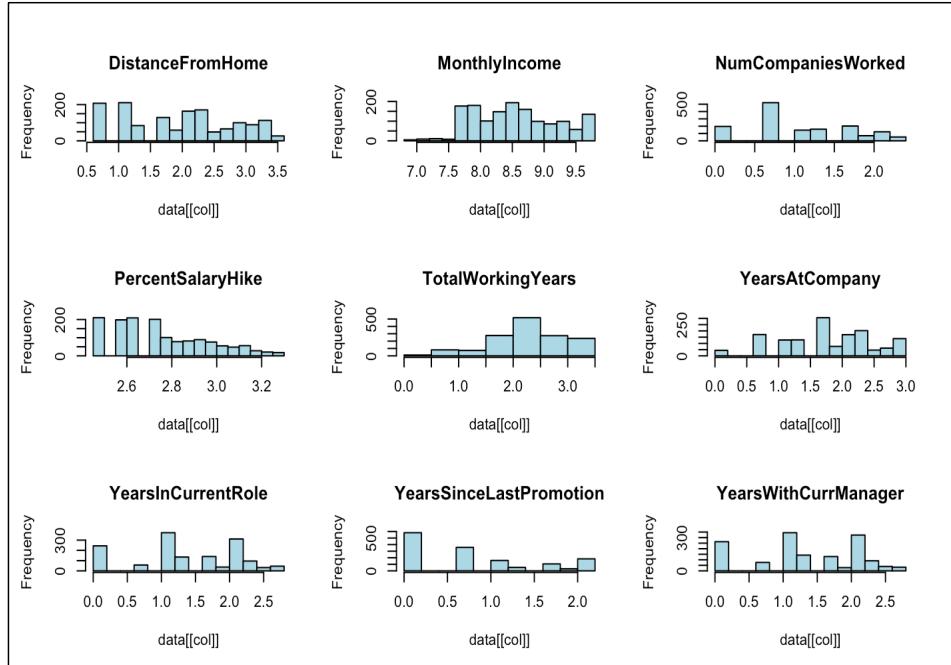
# After log transformation

```
```{r}
columns_to_transform <- c(
  "DistanceFromHome",
  "MonthlyIncome",
  "NumCompaniesWorked",
  "PercentSalaryHike",
  "TotalWorkingYears",
  "YearsAtCompany",
  "YearsInCurrentRole",
  "YearsSinceLastPromotion",
  "YearsWithCurrManager"
)

for (col in columns_to_transform) {
  data[[col]] <- ifelse(data[[col]] > 0, log(data[[col]] + 1), 0)
}

par(mfrow = c(3, 3))
for (col in columns_to_transform) {
  hist(data[[col]], main = col, col = "lightblue", border = "black")
}
```

```

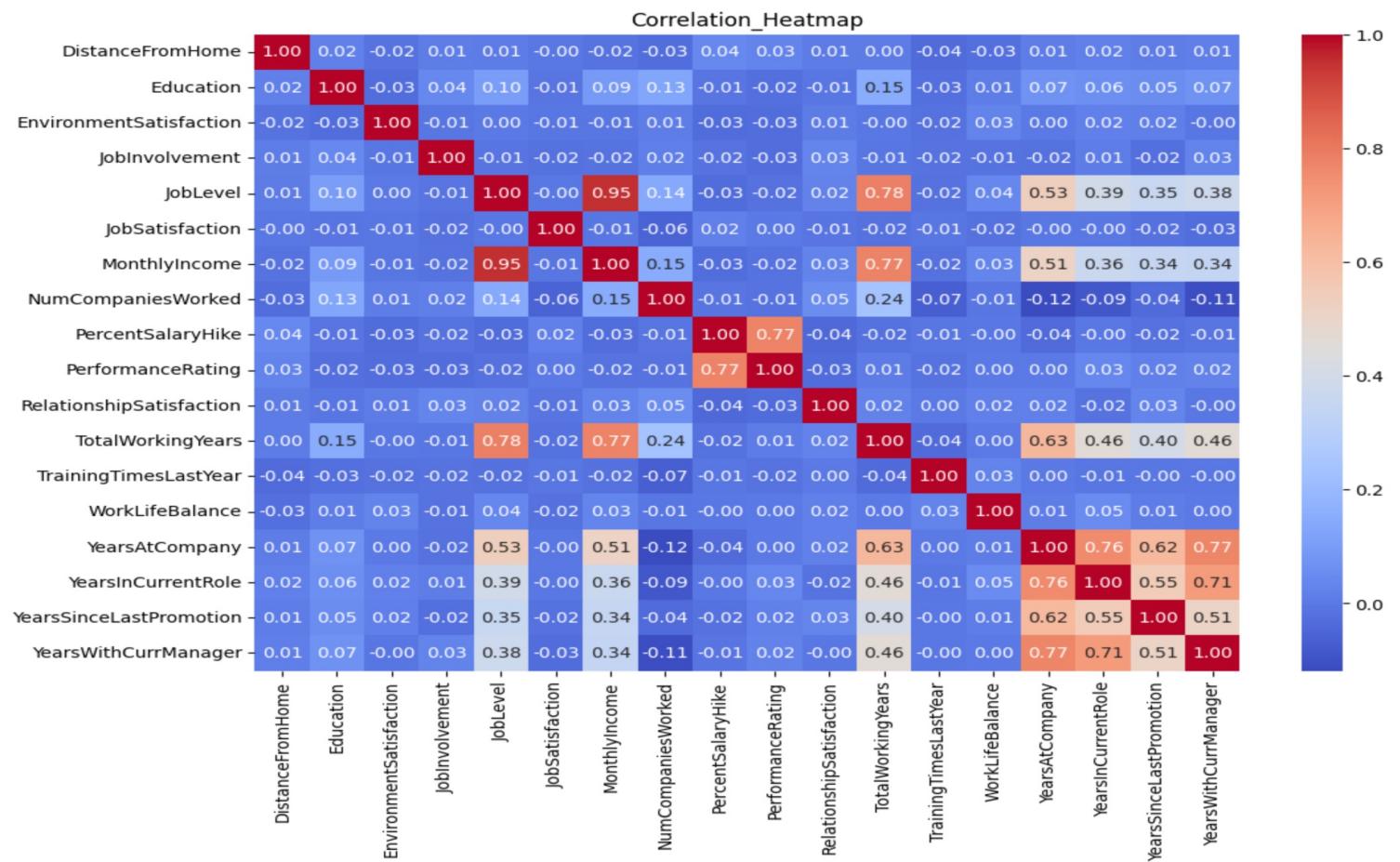


# Correlation coefficient Test

---

- We conducted a correlation test to assess the strength of association among the variables in our dataset.

```
corr_matrix = df.corr(numeric_only=True)
plt.figure(figsize=(12, 8))
sns.heatmap(corr_matrix, annot=True, cmap='coolwarm', fmt=".2f")
plt.title('Correlation_Heatmap')
plt.show()
```



# Fisher's exact test

---

- We conducted Fisher's Exact Test to assess the association between variables.

```
```{r}
your_data <- lapply(data, as.factor)
your_data <- as.data.frame(your_data)

variable_pairs <- combn(names(your_data), 2, simplify = TRUE)
associations <- list()

# Perform Fisher's Exact Test for each pair
for (i in seq(ncol(variable_pairs))) {
  # Create contingency table
  contingency_table <- table(your_data[, variable_pairs[1, i]], your_data[, variable_pairs[2, i]])

  if (all(dim(contingency_table) >= 2)) {
    test_result <- fisher.test(contingency_table, simulate.p.value = TRUE)

    # Check if the p-value is below a significance threshold (e.g., 0.05)
    if (test_result$p.value < 0.05) {
      associations[[paste(variable_pairs[1, i], variable_pairs[2, i], sep = "_")]] <- test_result
    }
  } else {
    cat("Insufficient data for Fisher's Exact Test for", variable_pairs[1, i], "and", variable_pairs[2, i], "\n")
  }
}

# Print the list of associations
cat("List of associations:\n")
print(associations)
```

```

```
List of associations:  
$Age_Attrition  
  
Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)  
  
data: contingency_table  
p-value = 0.0004998  
alternative hypothesis: two.sided  
  
$Age_Education  
  
Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)  
  
data: contingency_table  
p-value = 0.0004998  
alternative hypothesis: two.sided  
  
$Age_JobLevel  
  
Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)  
  
data: contingency_table  
p-value = 0.0004998  
alternative hypothesis: two.sided  
  
$Age_JobRole  
  
Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)  
  
data: contingency_table  
p-value = 0.0004998  
alternative hypothesis: two.sided
```

```
$Age_MaritalStatus  
  
Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)  
  
data: contingency_table  
p-value = 0.0004998  
alternative hypothesis: two.sided  
  
$Age_MonthlyIncome  
  
Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)  
  
data: contingency_table  
p-value = 0.0004998  
alternative hypothesis: two.sided  
  
$Age_NumCompaniesWorked  
  
Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)  
  
data: contingency_table  
p-value = 0.0004998  
alternative hypothesis: two.sided  
  
$Age_TotalWorkingYears  
  
Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)  
  
data: contingency_table  
p-value = 0.0004998  
alternative hypothesis: two.sided
```

# Multiple Linear Regression

---

- In accordance with the first research question, we conducted a multiple linear regression where the monthly income serves as the response variable, and the remaining variables act as predictors.

```
```{r}
model = lm(MonthlyIncome ~ Age + Attrition + BusinessTravel + Department + DistanceFromHome + Education + EducationField +
EnvironmentSatisfaction + Gender + JobInvolvement + JobLevel + JobRole + JobSatisfaction + MaritalStatus + NumCompaniesWorked +
OverTime + PercentSalaryHike + PerformanceRating + RelationshipSatisfaction + TotalWorkingYears + TrainingTimesLastYear +
WorkLifeBalance + YearsAtCompany + YearsInCurrentRole + YearsSinceLastPromotion + YearsWithCurrManager, data = data)

summary(model)
````
```

- Since the p-value is below 0.05 for certain variables, we aim to select those specific variables and rerun the model to assess the R<sup>2</sup> and adjusted R<sup>2</sup> values.

|   |  |
|---|--|
| Call:   |  |
| lm(formula = MonthlyIncome ~ Age + Attrition + BusinessTravel + Department + DistanceFromHome + Education + EducationField + EnvironmentSatisfaction + Gender + JobInvolvement + JobLevel + JobRole + JobSatisfaction + MaritalStatus + NumCompaniesWorked + OverTime + PercentSalaryHike + PerformanceRating + RelationshipSatisfaction + TotalWorkingYears + TrainingTimesLastYear + WorkLifeBalance + YearsAtCompany + YearsInCurrentRole + YearsSinceLastPromotion + YearsWithCurrManager, data = data) |  |
| Residuals:  |  |
| Min 1Q Median 3Q Max  | -3874.3 -807.9 -76.5 764.1 4263.1              |
| Coefficients:   |  |
|   | Estimate Std. Error t value Pr(> t )           |
| (Intercept)   | 853.4386 619.2415 1.378 0.168357               |
| Age   | -4.9529 4.7598 -1.041 0.298253                 |
| AttritionYes  | -39.4037 94.9364 -0.415 0.678165               |
| BusinessTravelTravel_Frequently   | 153.6341 119.4688 1.286 0.198660               |
| BusinessTravelTravel_Rarely   | 143.1395 102.4193 1.398 0.162455               |
| DepartmentResearch & Development  | 494.9235 418.9965 1.181 0.237715               |
| DepartmentSales   | 558.8567 434.6649 1.286 0.198750               |
| DistanceFromHome  | -0.6997 3.7680 -0.186 0.852701                 |
| Education   | 7.5249 30.6090 0.246 0.805841                  |
| EducationFieldLife Sciences   | 30.1462 300.3375 0.100 0.920061                |
| EducationFieldMarketing   | 39.4030 319.8898 0.123 0.901984                |
| EducationFieldMedical   | 5.4063 301.4948 0.018 0.985696                 |
| EducationFieldOther   | -69.1657 322.5355 -0.214 0.830232              |
| EducationFieldTechnical Degree  | 140.9911 313.4248 0.450 0.652894               |
| EnvironmentSatisfaction   | -14.9401 28.2282 -0.529 0.596707               |
| GenderMale  | 53.3323 62.5225 0.853 0.393797                 |
| JobInvolvement  | -73.6859 43.2581 -1.703 0.088711 .             |
| JobLevel  | 2354.3484 70.1638 33.555 < 2e-16 ***           |
| JobRoleHuman Resources  | -110.9667 438.7394 -0.253 0.800365             |
| JobRoleLaboratory Technician  | -978.9379 143.0894 -6.841 1.16e-11 ***         |
| JobRoleManager  | 3543.8164 214.8507 16.494 < 2e-16 ***          |
| JobRoleManufacturing Director   | -55.3790 140.6398 -0.394 0.693813              |
| JobRoleResearch Director  | 3636.0091 186.7315 19.472 < 2e-16 ***          |
| JobRoleResearch Scientist   | -928.5219 141.2778 -6.572 6.92e-11 ***         |
| JobRoleSales Executive  | -139.1149 277.5854 -0.501 0.616335             |
| JobRoleSales Representative   | -1172.6704 309.3222 -3.791 0.000156 ***        |
| JobSatisfaction   | -16.6929 27.8134 -0.600 0.548485               |
| MaritalStatusMarried  | 64.8594 78.6620 0.825 0.409775                 |
| MaritalStatusSingle   | 52.7054 85.4619 0.617 0.537522                 |
| NumCompaniesWorked  | 15.5706 14.0264 1.110 0.267146                 |
| OvertimeYes   | 93.8492 70.9577 1.323 0.186177                 |
| PercentSalaryHike   | 20.6346 13.1821 1.565 0.117724                 |
| PerformanceRating   | -173.8060 133.3113 -1.304 0.192525             |
| RelationshipSatisfaction  | 12.1528 28.3088 0.429 0.667775                 |
| TotalWorkingYears   | 58.7051 9.1827 6.393 2.20e-10 ***              |
| TrainingTimesLastYear   | -29.2607 23.8241 -1.228 0.219576               |
| WorkLifeBalance   | -21.1924 43.3522 -0.489 0.625029               |
| YearsAtCompany  | 28.6468 15.6904 1.826 0.068095 .               |
| YearsInCurrentRole  | 0.9785 15.7646 0.062 0.950516                  |
| YearsSinceLastPromotion   | 24.4625 15.5024 1.578 0.114791                 |
| YearsWithCurrManager  | -53.1801 15.9628 -3.332 0.000886 ***           |
| ---   |  |
| Signif. codes:  | 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 |
| Residual standard error:  | 1156 on 1429 degrees of freedom                |
| Multiple R-squared:   | 0.9314, Adjusted R-squared: 0.9295             |
| F-statistic:  | 485.4 on 40 and 1429 DF, p-value: < 2.2e-16    |

- Variables that demonstrate statistical significance have been chosen, and the model is being re-executed.

```
```{r}
model1 = lm(MonthlyIncome ~ JobLevel + JobRole, data = data)

summary(model1)
```

Call:
lm(formula = MonthlyIncome ~ JobLevel + JobRole, data = data)

Residuals:
    Min      1Q  Median      3Q     Max 
-3280.8 -851.2 -81.4  762.5 3967.9 

Coefficients:
            Estimate Std. Error t value Pr(>|t|)    
(Intercept)  790.73    173.77   4.551 5.80e-06 ***
JobLevel      2724.33    56.46   48.253 < 2e-16 ***
JobRoleHuman Resources -589.08   201.94  -2.917  0.00359 ** 
JobRoleLaboratory Technician -930.04   144.77  -6.424 1.79e-10 ***
JobRoleManager  3392.06   187.39   18.102 < 2e-16 ***
JobRoleManufacturing Director -165.50   142.69  -1.160  0.24630  
JobRoleResearch Director  3445.84   188.15   18.315 < 2e-16 ***
JobRoleResearch Scientist -825.55   143.69  -5.746 1.11e-08 ***
JobRoleSales Executive   -209.29   122.72  -1.705  0.08834 .  
JobRoleSales Representative -1118.82   183.65  -6.092 1.42e-09 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1184 on 1460 degrees of freedom
Multiple R-squared:  0.9265,    Adjusted R-squared:  0.9261 
F-statistic:  2045 on 9 and 1460 DF,  p-value: < 2.2e-16
```

- With an F-statistic of 2045 and a p-value below 0.005, there is ample evidence to reject the null hypothesis. However, to enhance the strength and confidence in rejecting the null hypothesis, we conducted ANOVA and pairwise t tests to signify the associations among the variable groups.

# ANOVA

---

- With a p-value below 0.05, we can confidently reject the null hypothesis, which posits that there is no significant difference among the variable groups. To delve deeper into the associations and discern specific differences between the groups, we proceeded with pairwise t-tests.

```
```{r}
#ANOVA |
summary(aov(MonthlyIncome ~ JobRole , data = data))
```



	Df	Sum Sq	Mean Sq	F value	Pr(>F)
JobRole	8	464.5	58.06	547.5	<2e-16 ***
Residuals	1461	155.0	0.11		


---
Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

# Pairwise t test

---

- The outcomes from both the ANOVA and pairwise t-tests align with the F-statistic results, providing consistent evidence to confidently reject the null hypothesis. This strengthens our confidence in the observed associations and underscores the robustness of the findings.

```
```{r}
pairwise.t.test(data$MonthlyIncome, data$JobRole, p.adj = "none")
```

Pairwise comparisons using t tests with pooled SD

data: data$MonthlyIncome and data$JobRole

Human Resources          Healthcare Representative Human Resources Laboratory Technician Manager Manufacturing Director
Human Resources           < 2e-16                   -                  -                  -                  -
Laboratory Technician    < 2e-16                   0.00013            -                  -                  -
Manager                  < 2e-16                   < 2e-16             < 2e-16             -                  -
Manufacturing Director   0.31740                  < 2e-16             < 2e-16             < 2e-16             -
Research Director         < 2e-16                   < 2e-16             < 2e-16             0.23440            < 2e-16
Research Scientist        < 2e-16                   9.9e-05              0.95828            < 2e-16             < 2e-16
Sales Executive           0.01511                  < 2e-16             < 2e-16             < 2e-16             0.18931
Sales Representative      < 2e-16                   2.1e-11              1.4e-06            < 2e-16             < 2e-16
                                         Research Director Research Scientist Sales Executive
Human Resources           -                      -                  -                  -
Laboratory Technician    -                      -                  -                  -
Manager                  -                      -                  -                  -
Manufacturing Director   -                      -                  -                  -
Research Director         -                      -                  -                  -
Research Scientist        < 2e-16                 -                  -                  -
Sales Executive           < 2e-16                 < 2e-16             -                  -
Sales Representative      < 2e-16                 1.2e-06            < 2e-16             -
```

P value adjustment method: none

- The above results indicate that not all categories of the job role variable exhibit an association with the response variable. Since individual categories of a categorical variable cannot be dropped outright, we opted to perform encoding to separate these variables. Subsequently, we reran the model to assess the adjusted R<sup>2</sup>, providing a more nuanced evaluation of the variable associations.

```
```{r}
encoded_data <- cbind(data, model.matrix(~ JobRole - 1, data = data))

encoded_data <- encoded_data[, -which(names(encoded_data) %in% c("JobRole"))]

colnames(encoded_data)[colnames(encoded_data) == "JobRoleHuman Resources"] <- "JobRoleHumanResources"
colnames(encoded_data)[colnames(encoded_data) == "JobRoleLaboratory Technician"] <- "JobRoleLaboratoryTechnician"
colnames(encoded_data)[colnames(encoded_data) == "JobRoleManufacturing Director"] <- "JobRoleManufacturingDirector"
colnames(encoded_data)[colnames(encoded_data) == "JobRoleResearch Scientist"] <- "JobRoleResearchScientist"
colnames(encoded_data)[colnames(encoded_data) == "JobRoleSales Executive"] <- "JobRoleSalesExecutive"
colnames(encoded_data)[colnames(encoded_data) == "JobRoleSales Representative"] <- "JobRoleSalesRepresentative"
colnames(encoded_data)[colnames(encoded_data) == "JobRoleResearch Director"] <- "JobRoleResearchDirector"

```
```{r}
model1 = lm(MonthlyIncome ~ JobLevel + JobRoleHumanResources + JobRoleLaboratoryTechnician + JobRoleResearchScientist + JobRoleSalesRepresentative , data = encoded_data)

summary(model1)
```

Call:
lm(formula = MonthlyIncome ~ JobLevel + JobRoleHumanResources +
JobRoleLaboratoryTechnician + JobRoleResearchScientist +
JobRoleSalesRepresentative, data = encoded_data)

Residuals:
    Min      1Q  Median      3Q     Max 
-0.0175 -0.1747 -0.0049  0.1699  0.6013 

Coefficients:
            Estimate Std. Error t value Pr(>|t|)    
(Intercept) 7.802519  0.024490 318.599 < 2e-16 ***
JobLevel     0.431186  0.008178  52.725 < 2e-16 ***
JobRoleHumanResources -0.227332  0.036474 -6.233 5.98e-10 ***
JobRoleLaboratoryTechnician -0.313102  0.021609 -14.490 < 2e-16 ***
JobRoleResearchScientist -0.298462  0.021189 -14.086 < 2e-16 ***
JobRoleSalesRepresentative -0.445451  0.031394 -14.189 < 2e-16 ***

Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.2433 on 1464 degrees of freedom
Multiple R-squared:  0.8601,    Adjusted R-squared:  0.8596 
F-statistic: 1800 on 5 and 1464 DF,  p-value: < 2.2e-16
```

Equation:

Monthly income = 7.802 + 0.431 (Job Level) - 0.227  
(JobRoleHumanResources) -0.313(JobRoleLaboratoryTechnician)  
0.298(JobRoleResearchScientist) -0.445 (JobRoleSalesRepresentative).

- We obtained a conclusive adjusted R2 value of 0.8596, signifying a robust model fit. The variables demonstrating significant associations with the response variable, monthly income, were identified.
- To further explore adjusted R2 changes, we conducted interactions with the predictors, examining their effects on the response variable. This additional step allowed us to gauge how the interplay between predictors influences the overall model performance and its explanatory power.

```
```{r}
model2 = lm(MonthlyIncome ~ JobLevel + JobRole + JobLevel*JobRole, data = data)
summary(model2)
```

Call:
lm(formula = MonthlyIncome ~ JobLevel + JobRole + JobLevel *
    JobRole, data = data)

Residuals:
    Min      1Q      Median      3Q      Max 
-0.99371 -0.13786 -0.01523  0.13747  0.61013 

Coefficients:
            Estimate Std. Error t value Pr(>|t|)    
(Intercept) 7.783578  0.080978 96.119 < 2e-16 ***
JobLevel     0.439946  0.031753 13.855 < 2e-16 ***
JobRoleHuman Resources -0.553317  0.109648 -5.046 5.07e-07 ***
JobRoleLaboratory Technician -0.288425  0.090722 -3.179  0.00151 ** 
JobRoleManager 1.404181  0.166781  8.419 < 2e-16 ***
JobRoleManufacturing Director -0.122751  0.111311 -1.103  0.27031  
JobRoleResearch Director   1.291956  0.148844  8.680 < 2e-16 *** 
JobRoleResearch Scientist -0.421273  0.090753 -4.642 3.76e-06 ***
JobRoleSales Executive   -0.038403  0.097396 -0.394  0.69342  
JobRoleSales Representative -0.397669  0.128616 -3.092  0.00203 ** 
JobLevel:JobRoleHuman Resources 0.224176  0.055252  4.057 5.23e-05 ***
JobLevel:JobRoleLaboratory Technician -0.013389  0.044374 -0.302  0.76290  
JobLevel:JobRoleManager   -0.327938  0.046139 -7.108 1.85e-12 ***
JobLevel:JobRoleManufacturing Director 0.038594  0.043847  0.880  0.37889  
JobLevel:JobRoleResearch Director -0.304993  0.044215 -6.898 7.85e-12 ***
JobLevel:JobRoleResearch Scientist  0.109165  0.045265  2.412  0.01600 *  
JobLevel:JobRoleSales Executive   0.008705  0.038982  0.223  0.82332  
JobLevel:JobRoleSales Representative -0.035358  0.094745 -0.373  0.70906  
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.226 on 1452 degrees of freedom
Multiple R-squared:  0.8803, Adjusted R-squared:  0.8789 
F-statistic:  628 on 17 and 1452 DF,  p-value: < 2.2e-16
```

- Despite the increase in the adjusted R<sup>2</sup> value, it became apparent that numerous additional variables lacking statistical significance were contributing to the overall R<sup>2</sup> value. Consequently, we concluded that the introduced interactions had a limited impact on the R<sup>2</sup> value, indicating that the associated variables did not significantly enhance the explanatory power of the model.
- We examined the assumptions of multiple linear regression, focusing on the normality of residuals and constant variability of residuals.
- Normality of the residuals:

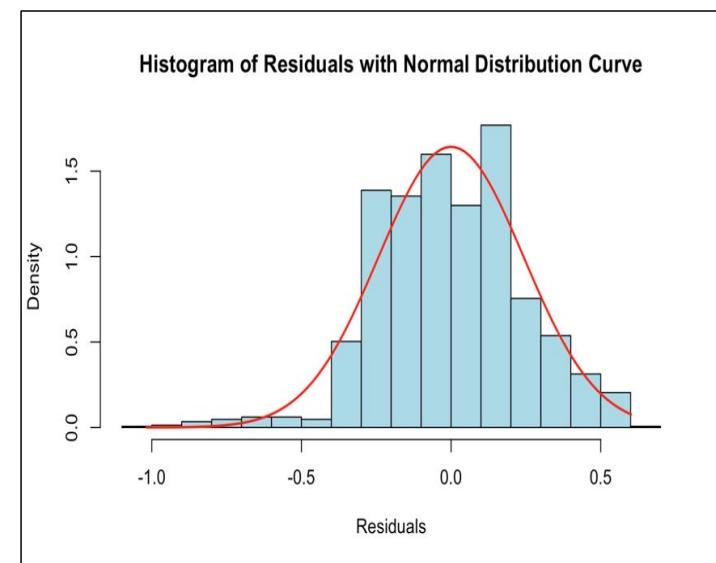
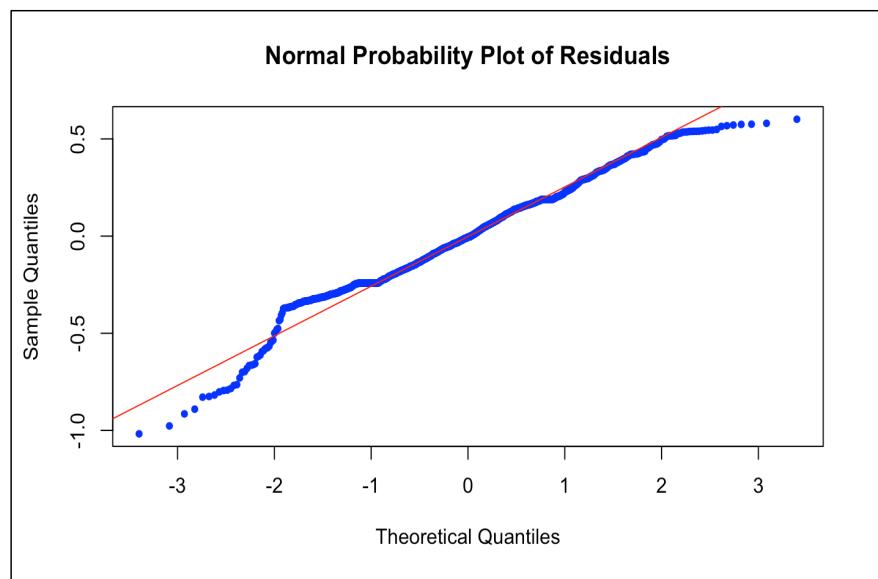
```
```{r}
residuals <- residuals(model1)

hist(residuals, main = "Histogram of Residuals with Normal Distribution Curve", col = "lightblue", border = "black", xlab = "Residuals", prob = TRUE)

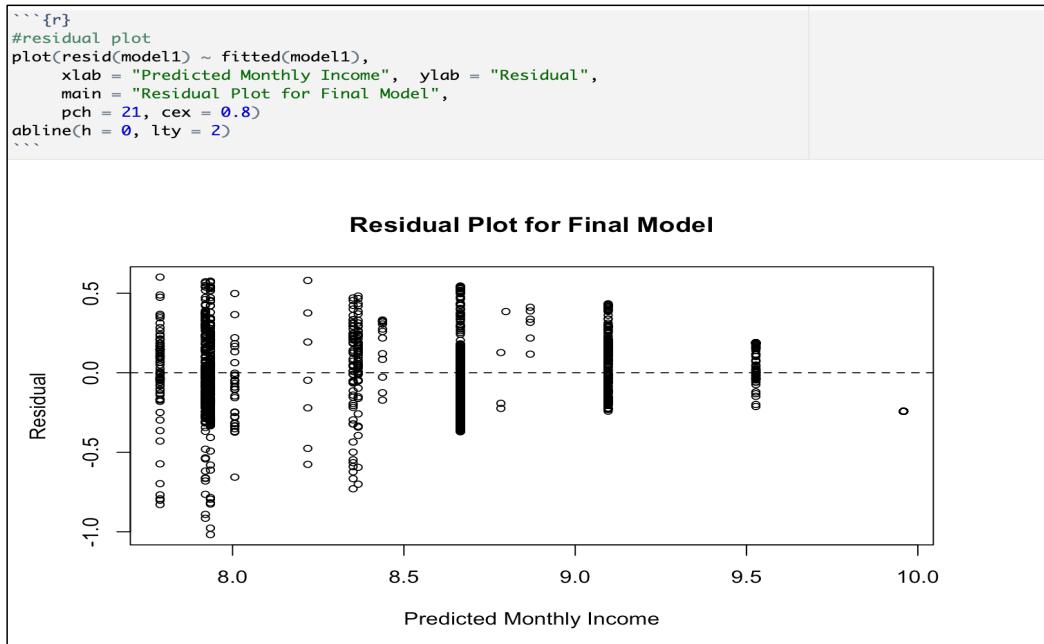
mu <- mean(residuals)
sigma <- sd(residuals)
x <- seq(min(residuals), max(residuals), length = 100)
lines(x, dnorm(x, mean = mu, sd = sigma), col = "red", lwd = 2)
|
qqnorm(residuals, main = "Normal Probability Plot of Residuals", col = "blue", pch = 20)
qqline(residuals, col = "red")
```

```

- Both indicate that the residuals adhere to the normal density pattern within the central range, but the fit is less optimal in the tails, characterized by a notable presence of large positive and negative values among the residuals.



- Constant variability is observed to be lower for higher values, suggesting that the model is not well-suited for accurately predicting the values.



# Conclusion to RQ1

---

- We reject the null hypothesis and state that there is a significant relationship between employee salaries and variables such job level, and department, allowing us to predict salaries effectively.
- The adjusted R<sup>2</sup> value of 0.86 in the ultimate model suggests that a significant portion of the observed variability in monthly income can be explained by job level and specific job roles. Among the measured features, job level and certain job roles (Human resources, Laboratory technician, Research scientist, Sales representative) exhibit the significant associations with monthly income.
- An increase in job level is correlated with a rise in monthly income; specifically, when job roles remain constant, the model predicts an average monthly income increase of 0.43 for every one-unit elevation in job level, holding other variables constant.
- However, despite these associations, the residual plots hint at potential inaccuracies in the final model. It may be prudent to explore higher-order models for a more refined understanding.

# Multiple Logistic Regression

---

- In response to the second research question, logistic regression was conducted, with attrition serving as the response variable and the remaining variables acting as predictors.
- Prior to executing logistic regression, we identified class imbalance within the response variable. Consequently, oversampling was carried out to address this imbalance in the context of a binary classification problem.

```
```{r}
minority_indices <- which(data$Attrition == "Yes")

data_oversampled <- data
oversampled_indices <- sample(minority_indices, replace = TRUE, size = length(setdiff(1:nrow(data), minority_indices)))
data_oversampled <- rbind(data_oversampled, data[oversampled_indices, ])

table(data_oversampled$Attrition)
```



No	Yes
1233	1470


```

We observed most of the predictors have a significant association with the response variable.

| <pre>```{r} model &lt;- glm(Attrition ~ Age + MonthlyIncome + BusinessTravel + Department +   DistanceFromHome + Education + EducationField + EnvironmentSatisfaction +   Gender + JobInvolvement + JobLevel + JobRole + JobSatisfaction +   MaritalStatus + NumCompaniesWorked + Overtime + PercentSalaryHike +   PerformanceRating + RelationshipSatisfaction + TotalWorkingYears +   TrainingTimesLastYear + WorklifeBalance + YearsAtCompany +   YearsInCurrentRole + YearsSinceLastPromotion + YearsWithCurrManager,   data = data_oversampled, family = binomial(link = "logit"))  summary(model) ``` </pre> <p>Call:</p> <pre>glmformula = Attrition ~ Age + MonthlyIncome + BusinessTravel +   Department + DistanceFromHome + Education + EducationField +   EnvironmentSatisfaction + Gender + JobInvolvement + JobLevel +   JobRole + JobSatisfaction + MaritalStatus + NumCompaniesWorked +   Overtime + PercentSalaryHike + PerformanceRating + RelationshipSatisfaction +   TotalWorkingYears + TrainingTimesLastYear + WorklifeBalance +   YearsAtCompany + YearsInCurrentRole + YearsSinceLastPromotion +   YearsWithCurrManager, family = binomial(link = "logit"),   data = data_oversampled)</pre> <p>Coefficients:</p> <table border="1"> <thead> <tr> <th></th> <th>Estimate</th> <th>Std. Error</th> <th>z value</th> <th>Pr(&gt; z )</th> </tr> </thead> <tbody> <tr> <td>(Intercept)</td> <td>-5.536452</td> <td>372.835812</td> <td>-0.015</td> <td>0.988152</td> </tr> <tr> <td>Age</td> <td>-0.003997</td> <td>0.007406</td> <td>-0.540</td> <td>0.589376</td> </tr> <tr> <td>MonthlyIncome</td> <td>-0.616045</td> <td>0.222382</td> <td>-2.770</td> <td>0.005602 **</td> </tr> <tr> <td>BusinessTravelTravel_Frequently</td> <td>1.785153</td> <td>0.226491</td> <td>7.882</td> <td>3.23e-15 ***</td> </tr> <tr> <td>BusinessTravelTravel_Rarely</td> <td>0.993786</td> <td>0.204030</td> <td>4.871</td> <td>1.11e-06 ***</td> </tr> <tr> <td>DepartmentResearch &amp; Development</td> <td>15.025332</td> <td>372.831100</td> <td>0.040</td> <td>0.967853</td> </tr> <tr> <td>DepartmentSales</td> <td>14.788808</td> <td>372.831234</td> <td>0.040</td> <td>0.968359</td> </tr> <tr> <td>DistanceFromHome</td> <td>0.368945</td> <td>0.063330</td> <td>5.826</td> <td>5.69e-09 ***</td> </tr> <tr> <td>Education</td> <td>0.020877</td> <td>0.052578</td> <td>0.397</td> <td>0.691324</td> </tr> <tr> <td>EducationFieldLife Sciences</td> <td>-1.094122</td> <td>0.493709</td> <td>-2.216</td> <td>0.026683 *</td> </tr> <tr> <td>EducationFieldMarketing</td> <td>-0.680583</td> <td>0.525747</td> <td>-1.295</td> <td>0.195490</td> </tr> </tbody> </table> |                       | Estimate            | Std. Error                     | z value                 | Pr(> z )   | (Intercept)    | -5.536452 | 372.835812             | -0.015                       | 0.988152       | Age                           | -0.003997                | 0.007406                  | -0.540                 | 0.589376                    | MonthlyIncome   | -0.616045            | 0.222382            | -2.770             | 0.005602 **  | BusinessTravelTravel_Frequently | 1.785153          | 0.226491                 | 7.882             | 3.23e-15 ***          | BusinessTravelTravel_Rarely | 0.993786       | 0.204030           | 4.871                   | 1.11e-06 ***         | DepartmentResearch & Development | 15.025332 | 372.831100 | 0.040    | 0.967853 | DepartmentSales | 14.788808 | 372.831234 | 0.040 | 0.968359 | DistanceFromHome | 0.368945 | 0.063330 | 5.826       | 5.69e-09 *** | Education | 0.020877 | 0.052578    | 0.397    | 0.691324 | EducationFieldLife Sciences | -1.094122  | 0.493709 | -2.216   | 0.026683 * | EducationFieldMarketing | -0.680583 | 0.525747 | -1.295 | 0.195490     | <table border="1"> <thead> <tr> <th></th> <th>EducationFieldMedical</th> <th>EducationFieldOther</th> <th>EducationFieldTechnical Degree</th> <th>EnvironmentSatisfaction</th> <th>GenderMale</th> <th>JobInvolvement</th> <th>JobLevel</th> <th>JobRoleHuman Resources</th> <th>JobRoleLaboratory Technician</th> <th>JobRoleManager</th> <th>JobRoleManufacturing Director</th> <th>JobRoleResearch Director</th> <th>JobRoleResearch Scientist</th> <th>JobRoleSales Executive</th> <th>JobRoleSales Representative</th> <th>JobSatisfaction</th> <th>MaritalStatusMarried</th> <th>MaritalStatusSingle</th> <th>NumCompaniesWorked</th> <th>OvertimeYes</th> <th>PercentSalaryHike</th> <th>PerformanceRating</th> <th>RelationshipSatisfaction</th> <th>TotalWorkingYears</th> <th>TrainingTimesLastYear</th> <th>WorklifeBalance</th> <th>YearsAtCompany</th> <th>YearsInCurrentRole</th> <th>YearsSinceLastPromotion</th> <th>YearsWithCurrManager</th> </tr> </thead> <tbody> <tr> <td></td> <td>-0.815641</td> <td>0.489306</td> <td>-1.667</td> <td>0.095527 .</td> <td>-0.533487</td> <td>0.524854</td> <td>-1.016</td> <td>0.309416</td> <td>0.270395</td> <td>0.507344</td> <td>0.533</td> <td>0.594060</td> <td>-0.503246</td> <td>0.049237</td> <td>-10.221</td> <td>&lt; 2e-16 ***</td> <td>0.476691</td> <td>0.110623</td> <td>4.309</td> <td>1.64e-05 ***</td> <td>-0.489756</td> <td>0.074325</td> <td>-6.589</td> <td>4.42e-11 ***</td> <td>0.442615</td> <td>0.141313</td> <td>3.132</td> <td>0.001735 **</td> <td>16.342960</td> <td>372.831176</td> <td>0.044</td> <td>0.965036</td> <td>1.512235</td> <td>0.286010</td> <td>5.287</td> <td>1.24e-07 ***</td> <td>0.438690</td> <td>0.403344</td> <td>1.088</td> <td>0.276758</td> <td>0.843003</td> <td>0.281340</td> <td>2.996</td> <td>0.002732 **</td> <td>-1.414074</td> <td>0.516899</td> <td>-2.736</td> <td>0.006225 **</td> <td>0.670020</td> <td>0.287902</td> <td>2.327</td> <td>0.019952 *</td> <td>1.443128</td> <td>0.579892</td> <td>2.489</td> <td>0.012824 *</td> <td>2.311752</td> <td>0.629742</td> <td>3.671</td> <td>0.000242 ***</td> <td>-0.370285</td> <td>0.048075</td> <td>-7.702</td> <td>1.34e-14 ***</td> <td>0.691127</td> <td>0.148825</td> <td>4.644</td> <td>3.42e-06 ***</td> <td>1.620060</td> <td>0.156289</td> <td>10.366</td> <td>&lt; 2e-16 ***</td> <td>0.696545</td> <td>0.0933807</td> <td>7.425</td> <td>1.13e-13 ***</td> <td>1.857652</td> <td>0.113279</td> <td>16.399</td> <td>&lt; 2e-16 ***</td> <td>-1.125843</td> <td>0.358913</td> <td>-3.137</td> <td>0.001708 **</td> <td>0.188404</td> <td>0.218592</td> <td>0.862</td> <td>0.388744</td> <td>-0.265524</td> <td>0.048286</td> <td>-5.499</td> <td>3.82e-08 ***</td> <td>-0.787626</td> <td>0.150225</td> <td>-5.243</td> <td>1.58e-07 ***</td> <td>-0.190298</td> <td>0.041367</td> <td>-4.600</td> <td>4.22e-06 ***</td> <td>-0.337074</td> <td>0.069592</td> <td>-4.844</td> <td>1.28e-06 ***</td> <td>0.599085</td> <td>0.191969</td> <td>3.121</td> <td>0.001804 **</td> <td>-0.551864</td> <td>0.132632</td> <td>-4.161</td> <td>3.17e-05 ***</td> <td>0.677830</td> <td>0.090991</td> <td>7.449</td> <td>9.38e-14 ***</td> <td>-0.529121</td> <td>0.120542</td> <td>-4.390</td> <td>1.14e-05 ***</td> </tr> </tbody> </table> <p>Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1</p> <p>(Dispersion parameter for binomial family taken to be 1)</p> <p>Null deviance: 3726.3 on 2702 degrees of freedom<br/> Residual deviance: 2354.3 on 2662 degrees of freedom<br/> AIC: 2436.3</p> <p>Number of Fisher Scoring iterations: 14</p> |          | EducationFieldMedical | EducationFieldOther | EducationFieldTechnical Degree | EnvironmentSatisfaction | GenderMale | JobInvolvement | JobLevel | JobRoleHuman Resources | JobRoleLaboratory Technician | JobRoleManager | JobRoleManufacturing Director | JobRoleResearch Director | JobRoleResearch Scientist | JobRoleSales Executive | JobRoleSales Representative | JobSatisfaction | MaritalStatusMarried | MaritalStatusSingle | NumCompaniesWorked | OvertimeYes | PercentSalaryHike | PerformanceRating | RelationshipSatisfaction | TotalWorkingYears | TrainingTimesLastYear | WorklifeBalance | YearsAtCompany | YearsInCurrentRole | YearsSinceLastPromotion | YearsWithCurrManager |           | -0.815641 | 0.489306 | -1.667       | 0.095527 . | -0.533487 | 0.524854 | -1.016       | 0.309416  | 0.270395 | 0.507344 | 0.533        | 0.594060 | -0.503246 | 0.049237 | -10.221     | < 2e-16 *** | 0.476691 | 0.110623 | 4.309        | 1.64e-05 *** | -0.489756 | 0.074325 | -6.589       | 4.42e-11 *** | 0.442615 | 0.141313 | 3.132        | 0.001735 ** | 16.342960 | 372.831176 | 0.044 | 0.965036 | 1.512235 | 0.286010 | 5.287 | 1.24e-07 *** | 0.438690 | 0.403344 | 1.088 | 0.276758 | 0.843003 | 0.281340 | 2.996 | 0.002732 ** | -1.414074 | 0.516899 | -2.736 | 0.006225 ** | 0.670020 | 0.287902 | 2.327 | 0.019952 * | 1.443128 | 0.579892 | 2.489 | 0.012824 * | 2.311752 | 0.629742 | 3.671 | 0.000242 *** | -0.370285 | 0.048075 | -7.702 | 1.34e-14 *** | 0.691127 | 0.148825 | 4.644 | 3.42e-06 *** | 1.620060 | 0.156289 | 10.366 | < 2e-16 *** | 0.696545 | 0.0933807 | 7.425 | 1.13e-13 *** | 1.857652 | 0.113279 | 16.399 | < 2e-16 *** | -1.125843 | 0.358913 | -3.137 | 0.001708 ** | 0.188404 | 0.218592 | 0.862 | 0.388744 | -0.265524 | 0.048286 | -5.499 | 3.82e-08 *** | -0.787626 | 0.150225 | -5.243 | 1.58e-07 *** | -0.190298 | 0.041367 | -4.600 | 4.22e-06 *** | -0.337074 | 0.069592 | -4.844 | 1.28e-06 *** | 0.599085 | 0.191969 | 3.121 | 0.001804 ** | -0.551864 | 0.132632 | -4.161 | 3.17e-05 *** | 0.677830 | 0.090991 | 7.449 | 9.38e-14 *** | -0.529121 | 0.120542 | -4.390 | 1.14e-05 *** |
|---|-----------------------|---------------------|--------------------------------|-------------------------|------------|----------------|-----------|------------------------|------------------------------|----------------|-------------------------------|--------------------------|---------------------------|------------------------|-----------------------------|-----------------|----------------------|---------------------|--------------------|--------------|---------------------------------|-------------------|--------------------------|-------------------|-----------------------|-----------------------------|----------------|--------------------|-------------------------|----------------------|----------------------------------|-----------|------------|----------|----------|-----------------|-----------|------------|-------|----------|------------------|----------|----------|-------------|--------------|-----------|----------|-------------|----------|----------|-----------------------------|------------|----------|----------|------------|-------------------------|-----------|----------|--------|--------------|---|----------|-----------------------|---------------------|--------------------------------|-------------------------|------------|----------------|----------|------------------------|------------------------------|----------------|-------------------------------|--------------------------|---------------------------|------------------------|-----------------------------|-----------------|----------------------|---------------------|--------------------|-------------|-------------------|-------------------|--------------------------|-------------------|-----------------------|-----------------|----------------|--------------------|-------------------------|----------------------|-----------|-----------|----------|--------------|------------|-----------|----------|--------------|-----------|----------|----------|--------------|----------|-----------|----------|-------------|-------------|----------|----------|--------------|--------------|-----------|----------|--------------|--------------|----------|----------|--------------|-------------|-----------|------------|-------|----------|----------|----------|-------|--------------|----------|----------|-------|----------|----------|----------|-------|-------------|-----------|----------|--------|-------------|----------|----------|-------|------------|----------|----------|-------|------------|----------|----------|-------|--------------|-----------|----------|--------|--------------|----------|----------|-------|--------------|----------|----------|--------|-------------|----------|-----------|-------|--------------|----------|----------|--------|-------------|-----------|----------|--------|-------------|----------|----------|-------|----------|-----------|----------|--------|--------------|-----------|----------|--------|--------------|-----------|----------|--------|--------------|-----------|----------|--------|--------------|----------|----------|-------|-------------|-----------|----------|--------|--------------|----------|----------|-------|--------------|-----------|----------|--------|--------------|
|   | Estimate              | Std. Error          | z value                        | Pr(> z )                |            |                |           |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |              |                                 |                   |                          |                   |                       |                             |                |                    |                         |                      |                                  |           |            |          |          |                 |           |            |       |          |                  |          |          |             |              |           |          |             |          |          |                             |            |          |          |            |                         |           |          |        |              |   |          |                       |                     |                                |                         |            |                |          |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |             |                   |                   |                          |                   |                       |                 |                |                    |                         |                      |           |           |          |              |            |           |          |              |           |          |          |              |          |           |          |             |             |          |          |              |              |           |          |              |              |          |          |              |             |           |            |       |          |          |          |       |              |          |          |       |          |          |          |       |             |           |          |        |             |          |          |       |            |          |          |       |            |          |          |       |              |           |          |        |              |          |          |       |              |          |          |        |             |          |           |       |              |          |          |        |             |           |          |        |             |          |          |       |          |           |          |        |              |           |          |        |              |           |          |        |              |           |          |        |              |          |          |       |             |           |          |        |              |          |          |       |              |           |          |        |              |
| (Intercept)   | -5.536452             | 372.835812          | -0.015                         | 0.988152                |            |                |           |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |              |                                 |                   |                          |                   |                       |                             |                |                    |                         |                      |                                  |           |            |          |          |                 |           |            |       |          |                  |          |          |             |              |           |          |             |          |          |                             |            |          |          |            |                         |           |          |        |              |   |          |                       |                     |                                |                         |            |                |          |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |             |                   |                   |                          |                   |                       |                 |                |                    |                         |                      |           |           |          |              |            |           |          |              |           |          |          |              |          |           |          |             |             |          |          |              |              |           |          |              |              |          |          |              |             |           |            |       |          |          |          |       |              |          |          |       |          |          |          |       |             |           |          |        |             |          |          |       |            |          |          |       |            |          |          |       |              |           |          |        |              |          |          |       |              |          |          |        |             |          |           |       |              |          |          |        |             |           |          |        |             |          |          |       |          |           |          |        |              |           |          |        |              |           |          |        |              |           |          |        |              |          |          |       |             |           |          |        |              |          |          |       |              |           |          |        |              |
| Age   | -0.003997             | 0.007406            | -0.540                         | 0.589376                |            |                |           |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |              |                                 |                   |                          |                   |                       |                             |                |                    |                         |                      |                                  |           |            |          |          |                 |           |            |       |          |                  |          |          |             |              |           |          |             |          |          |                             |            |          |          |            |                         |           |          |        |              |   |          |                       |                     |                                |                         |            |                |          |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |             |                   |                   |                          |                   |                       |                 |                |                    |                         |                      |           |           |          |              |            |           |          |              |           |          |          |              |          |           |          |             |             |          |          |              |              |           |          |              |              |          |          |              |             |           |            |       |          |          |          |       |              |          |          |       |          |          |          |       |             |           |          |        |             |          |          |       |            |          |          |       |            |          |          |       |              |           |          |        |              |          |          |       |              |          |          |        |             |          |           |       |              |          |          |        |             |           |          |        |             |          |          |       |          |           |          |        |              |           |          |        |              |           |          |        |              |           |          |        |              |          |          |       |             |           |          |        |              |          |          |       |              |           |          |        |              |
| MonthlyIncome   | -0.616045             | 0.222382            | -2.770                         | 0.005602 **             |            |                |           |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |              |                                 |                   |                          |                   |                       |                             |                |                    |                         |                      |                                  |           |            |          |          |                 |           |            |       |          |                  |          |          |             |              |           |          |             |          |          |                             |            |          |          |            |                         |           |          |        |              |   |          |                       |                     |                                |                         |            |                |          |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |             |                   |                   |                          |                   |                       |                 |                |                    |                         |                      |           |           |          |              |            |           |          |              |           |          |          |              |          |           |          |             |             |          |          |              |              |           |          |              |              |          |          |              |             |           |            |       |          |          |          |       |              |          |          |       |          |          |          |       |             |           |          |        |             |          |          |       |            |          |          |       |            |          |          |       |              |           |          |        |              |          |          |       |              |          |          |        |             |          |           |       |              |          |          |        |             |           |          |        |             |          |          |       |          |           |          |        |              |           |          |        |              |           |          |        |              |           |          |        |              |          |          |       |             |           |          |        |              |          |          |       |              |           |          |        |              |
| BusinessTravelTravel_Frequently   | 1.785153              | 0.226491            | 7.882                          | 3.23e-15 ***            |            |                |           |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |              |                                 |                   |                          |                   |                       |                             |                |                    |                         |                      |                                  |           |            |          |          |                 |           |            |       |          |                  |          |          |             |              |           |          |             |          |          |                             |            |          |          |            |                         |           |          |        |              |   |          |                       |                     |                                |                         |            |                |          |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |             |                   |                   |                          |                   |                       |                 |                |                    |                         |                      |           |           |          |              |            |           |          |              |           |          |          |              |          |           |          |             |             |          |          |              |              |           |          |              |              |          |          |              |             |           |            |       |          |          |          |       |              |          |          |       |          |          |          |       |             |           |          |        |             |          |          |       |            |          |          |       |            |          |          |       |              |           |          |        |              |          |          |       |              |          |          |        |             |          |           |       |              |          |          |        |             |           |          |        |             |          |          |       |          |           |          |        |              |           |          |        |              |           |          |        |              |           |          |        |              |          |          |       |             |           |          |        |              |          |          |       |              |           |          |        |              |
| BusinessTravelTravel_Rarely   | 0.993786              | 0.204030            | 4.871                          | 1.11e-06 ***            |            |                |           |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |              |                                 |                   |                          |                   |                       |                             |                |                    |                         |                      |                                  |           |            |          |          |                 |           |            |       |          |                  |          |          |             |              |           |          |             |          |          |                             |            |          |          |            |                         |           |          |        |              |   |          |                       |                     |                                |                         |            |                |          |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |             |                   |                   |                          |                   |                       |                 |                |                    |                         |                      |           |           |          |              |            |           |          |              |           |          |          |              |          |           |          |             |             |          |          |              |              |           |          |              |              |          |          |              |             |           |            |       |          |          |          |       |              |          |          |       |          |          |          |       |             |           |          |        |             |          |          |       |            |          |          |       |            |          |          |       |              |           |          |        |              |          |          |       |              |          |          |        |             |          |           |       |              |          |          |        |             |           |          |        |             |          |          |       |          |           |          |        |              |           |          |        |              |           |          |        |              |           |          |        |              |          |          |       |             |           |          |        |              |          |          |       |              |           |          |        |              |
| DepartmentResearch & Development  | 15.025332             | 372.831100          | 0.040                          | 0.967853                |            |                |           |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |              |                                 |                   |                          |                   |                       |                             |                |                    |                         |                      |                                  |           |            |          |          |                 |           |            |       |          |                  |          |          |             |              |           |          |             |          |          |                             |            |          |          |            |                         |           |          |        |              |   |          |                       |                     |                                |                         |            |                |          |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |             |                   |                   |                          |                   |                       |                 |                |                    |                         |                      |           |           |          |              |            |           |          |              |           |          |          |              |          |           |          |             |             |          |          |              |              |           |          |              |              |          |          |              |             |           |            |       |          |          |          |       |              |          |          |       |          |          |          |       |             |           |          |        |             |          |          |       |            |          |          |       |            |          |          |       |              |           |          |        |              |          |          |       |              |          |          |        |             |          |           |       |              |          |          |        |             |           |          |        |             |          |          |       |          |           |          |        |              |           |          |        |              |           |          |        |              |           |          |        |              |          |          |       |             |           |          |        |              |          |          |       |              |           |          |        |              |
| DepartmentSales   | 14.788808             | 372.831234          | 0.040                          | 0.968359                |            |                |           |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |              |                                 |                   |                          |                   |                       |                             |                |                    |                         |                      |                                  |           |            |          |          |                 |           |            |       |          |                  |          |          |             |              |           |          |             |          |          |                             |            |          |          |            |                         |           |          |        |              |   |          |                       |                     |                                |                         |            |                |          |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |             |                   |                   |                          |                   |                       |                 |                |                    |                         |                      |           |           |          |              |            |           |          |              |           |          |          |              |          |           |          |             |             |          |          |              |              |           |          |              |              |          |          |              |             |           |            |       |          |          |          |       |              |          |          |       |          |          |          |       |             |           |          |        |             |          |          |       |            |          |          |       |            |          |          |       |              |           |          |        |              |          |          |       |              |          |          |        |             |          |           |       |              |          |          |        |             |           |          |        |             |          |          |       |          |           |          |        |              |           |          |        |              |           |          |        |              |           |          |        |              |          |          |       |             |           |          |        |              |          |          |       |              |           |          |        |              |
| DistanceFromHome  | 0.368945              | 0.063330            | 5.826                          | 5.69e-09 ***            |            |                |           |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |              |                                 |                   |                          |                   |                       |                             |                |                    |                         |                      |                                  |           |            |          |          |                 |           |            |       |          |                  |          |          |             |              |           |          |             |          |          |                             |            |          |          |            |                         |           |          |        |              |   |          |                       |                     |                                |                         |            |                |          |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |             |                   |                   |                          |                   |                       |                 |                |                    |                         |                      |           |           |          |              |            |           |          |              |           |          |          |              |          |           |          |             |             |          |          |              |              |           |          |              |              |          |          |              |             |           |            |       |          |          |          |       |              |          |          |       |          |          |          |       |             |           |          |        |             |          |          |       |            |          |          |       |            |          |          |       |              |           |          |        |              |          |          |       |              |          |          |        |             |          |           |       |              |          |          |        |             |           |          |        |             |          |          |       |          |           |          |        |              |           |          |        |              |           |          |        |              |           |          |        |              |          |          |       |             |           |          |        |              |          |          |       |              |           |          |        |              |
| Education   | 0.020877              | 0.052578            | 0.397                          | 0.691324                |            |                |           |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |              |                                 |                   |                          |                   |                       |                             |                |                    |                         |                      |                                  |           |            |          |          |                 |           |            |       |          |                  |          |          |             |              |           |          |             |          |          |                             |            |          |          |            |                         |           |          |        |              |   |          |                       |                     |                                |                         |            |                |          |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |             |                   |                   |                          |                   |                       |                 |                |                    |                         |                      |           |           |          |              |            |           |          |              |           |          |          |              |          |           |          |             |             |          |          |              |              |           |          |              |              |          |          |              |             |           |            |       |          |          |          |       |              |          |          |       |          |          |          |       |             |           |          |        |             |          |          |       |            |          |          |       |            |          |          |       |              |           |          |        |              |          |          |       |              |          |          |        |             |          |           |       |              |          |          |        |             |           |          |        |             |          |          |       |          |           |          |        |              |           |          |        |              |           |          |        |              |           |          |        |              |          |          |       |             |           |          |        |              |          |          |       |              |           |          |        |              |
| EducationFieldLife Sciences   | -1.094122             | 0.493709            | -2.216                         | 0.026683 *              |            |                |           |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |              |                                 |                   |                          |                   |                       |                             |                |                    |                         |                      |                                  |           |            |          |          |                 |           |            |       |          |                  |          |          |             |              |           |          |             |          |          |                             |            |          |          |            |                         |           |          |        |              |   |          |                       |                     |                                |                         |            |                |          |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |             |                   |                   |                          |                   |                       |                 |                |                    |                         |                      |           |           |          |              |            |           |          |              |           |          |          |              |          |           |          |             |             |          |          |              |              |           |          |              |              |          |          |              |             |           |            |       |          |          |          |       |              |          |          |       |          |          |          |       |             |           |          |        |             |          |          |       |            |          |          |       |            |          |          |       |              |           |          |        |              |          |          |       |              |          |          |        |             |          |           |       |              |          |          |        |             |           |          |        |             |          |          |       |          |           |          |        |              |           |          |        |              |           |          |        |              |           |          |        |              |          |          |       |             |           |          |        |              |          |          |       |              |           |          |        |              |
| EducationFieldMarketing   | -0.680583             | 0.525747            | -1.295                         | 0.195490                |            |                |           |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |              |                                 |                   |                          |                   |                       |                             |                |                    |                         |                      |                                  |           |            |          |          |                 |           |            |       |          |                  |          |          |             |              |           |          |             |          |          |                             |            |          |          |            |                         |           |          |        |              |   |          |                       |                     |                                |                         |            |                |          |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |             |                   |                   |                          |                   |                       |                 |                |                    |                         |                      |           |           |          |              |            |           |          |              |           |          |          |              |          |           |          |             |             |          |          |              |              |           |          |              |              |          |          |              |             |           |            |       |          |          |          |       |              |          |          |       |          |          |          |       |             |           |          |        |             |          |          |       |            |          |          |       |            |          |          |       |              |           |          |        |              |          |          |       |              |          |          |        |             |          |           |       |              |          |          |        |             |           |          |        |             |          |          |       |          |           |          |        |              |           |          |        |              |           |          |        |              |           |          |        |              |          |          |       |             |           |          |        |              |          |          |       |              |           |          |        |              |
|   | EducationFieldMedical | EducationFieldOther | EducationFieldTechnical Degree | EnvironmentSatisfaction | GenderMale | JobInvolvement | JobLevel  | JobRoleHuman Resources | JobRoleLaboratory Technician | JobRoleManager | JobRoleManufacturing Director | JobRoleResearch Director | JobRoleResearch Scientist | JobRoleSales Executive | JobRoleSales Representative | JobSatisfaction | MaritalStatusMarried | MaritalStatusSingle | NumCompaniesWorked | OvertimeYes  | PercentSalaryHike               | PerformanceRating | RelationshipSatisfaction | TotalWorkingYears | TrainingTimesLastYear | WorklifeBalance             | YearsAtCompany | YearsInCurrentRole | YearsSinceLastPromotion | YearsWithCurrManager |                                  |           |            |          |          |                 |           |            |       |          |                  |          |          |             |              |           |          |             |          |          |                             |            |          |          |            |                         |           |          |        |              |   |          |                       |                     |                                |                         |            |                |          |                        |                              |                |                               |                          |                           |                        |                             |                 |                      |                     |                    |             |                   |                   |                          |                   |                       |                 |                |                    |                         |                      |           |           |          |              |            |           |          |              |           |          |          |              |          |           |          |             |             |          |          |              |              |           |          |              |              |          |          |              |             |           |            |       |          |          |          |       |              |          |          |       |          |          |          |       |             |           |          |        |             |          |          |       |            |          |          |       |            |          |          |       |              |           |          |        |              |          |          |       |              |          |          |        |             |          |           |       |              |          |          |        |             |           |          |        |             |          |          |       |          |           |          |        |              |           |          |        |              |           |          |        |              |           |          |        |              |          |          |       |             |           |          |        |              |          |          |       |              |           |          |        |              |
|   | -0.815641             | 0.489306            | -1.667                         | 0.095527 .              | -0.533487  | 0.524854       | -1.016    | 0.309416               | 0.270395                     | 0.507344       | 0.533                         | 0.594060                 | -0.503246                 | 0.049237               | -10.221                     | < 2e-16 ***     | 0.476691             | 0.110623            | 4.309              | 1.64e-05 *** | -0.489756                       | 0.074325          | -6.589                   | 4.42e-11 ***      | 0.442615              | 0.141313                    | 3.132          | 0.001735 **        | 16.342960               | 372.831176           | 0.044                            | 0.965036  | 1.512235   | 0.286010 | 5.287    | 1.24e-07 ***    | 0.438690  | 0.403344   | 1.088 | 0.276758 | 0.843003         | 0.281340 | 2.996    | 0.002732 ** | -1.414074    | 0.516899  | -2.736   | 0.006225 ** | 0.670020 | 0.287902 | 2.327                       | 0.019952 * | 1.443128 | 0.579892 | 2.489      | 0.012824 *              | 2.311752  | 0.629742 | 3.671  | 0.000242 *** | -0.370285   | 0.048075 | -7.702                | 1.34e-14 ***        | 0.691127                       | 0.148825                | 4.644      | 3.42e-06 ***   | 1.620060 | 0.156289               | 10.366                       | < 2e-16 ***    | 0.696545                      | 0.0933807                | 7.425                     | 1.13e-13 ***           | 1.857652                    | 0.113279        | 16.399               | < 2e-16 ***         | -1.125843          | 0.358913    | -3.137            | 0.001708 **       | 0.188404                 | 0.218592          | 0.862                 | 0.388744        | -0.265524      | 0.048286           | -5.499                  | 3.82e-08 ***         | -0.787626 | 0.150225  | -5.243   | 1.58e-07 *** | -0.190298  | 0.041367  | -4.600   | 4.22e-06 *** | -0.337074 | 0.069592 | -4.844   | 1.28e-06 *** | 0.599085 | 0.191969  | 3.121    | 0.001804 ** | -0.551864   | 0.132632 | -4.161   | 3.17e-05 *** | 0.677830     | 0.090991  | 7.449    | 9.38e-14 *** | -0.529121    | 0.120542 | -4.390   | 1.14e-05 *** |             |           |            |       |          |          |          |       |              |          |          |       |          |          |          |       |             |           |          |        |             |          |          |       |            |          |          |       |            |          |          |       |              |           |          |        |              |          |          |       |              |          |          |        |             |          |           |       |              |          |          |        |             |           |          |        |             |          |          |       |          |           |          |        |              |           |          |        |              |           |          |        |              |           |          |        |              |          |          |       |             |           |          |        |              |          |          |       |              |           |          |        |              |

Conclusion to RQ2: We reject the null hypothesis and state that there is a significant relationship between job-related factors (job level, department, job satisfaction) and employee attrition within the company.

# Ordinary Least Squares regression

- In accordance with the third research question, we performed the association between performance ratings (the response variable) and specific predictors.

```
```{r}
install.packages("ordinal")
library(ordinal)

data$PerformanceRating <- ordered(data$PerformanceRating)

model3 <- clm(PerformanceRating ~ JobSatisfaction + EnvironmentSatisfaction + RelationshipSatisfaction +
  WorkLifeBalance, data = data)
| 
summary(model3)
```
``
```

```
The downloaded binary packages are in
  /var/folders/l7/k8n1pmmx5fb2wnz3twy15930000gn/T//Rtmp9BqqU2/downloaded_packages
formula: PerformanceRating ~ JobSatisfaction + EnvironmentSatisfaction + RelationshipSatisfaction
+ WorkLifeBalance
data:   data

Coefficients:
Estimate Std. Error z value Pr(>|z|)
JobSatisfaction 0.004497 0.065761 0.068 0.945
EnvironmentSatisfaction -0.074077 0.065780 -1.126 0.260
RelationshipSatisfaction -0.079327 0.066427 -1.194 0.232
WorkLifeBalance 0.015907 0.102624 0.155 0.877

Threshold coefficients:
Estimate Std. Error z value
3|4 1.3499 0.4212 3.205
```

As none of the selected predictors have a significant association with the response variable. We decided to rerun the model with almost all the predictors.

- None of the predictors have shown significant association with the response variable.

```
```{r}
model4 <- clm(PerformanceRating ~ JobSatisfaction + EnvironmentSatisfaction + RelationshipSatisfaction + WorkLifeBalance +
JobInvolvement + DistanceFromHome + TotalWorkingYears + Education + JobLevel + NumCompaniesWorked + TotalWorkingYears +
TrainingTimesLastYear + WorkLifeBalance + YearsAtCompany + YearsInCurrentRole + YearsSinceLastPromotion + YearsWithCurrManager
, data = data)

summary(model4)
```

```

```
+ YearsInCurrentRole + YearsSinceLastPromotion + YearsWithCurrManager
data: data

Coefficients:
Estimate Std. Error z value Pr(>|z|)
JobSatisfaction 0.006125 0.066116 0.093 0.926
EnvironmentSatisfaction -0.078050 0.066210 -1.179 0.238
RelationshipSatisfaction -0.070266 0.066814 -1.052 0.293
WorkLifeBalance 0.019066 0.103878 0.184 0.854
JobInvolvement -0.117780 0.100651 -1.170 0.242
DistanceFromHome 0.008557 0.008733 0.980 0.327
TotalWorkingYears 0.026002 0.017006 1.529 0.126
Education -0.076855 0.071914 -1.069 0.285
JobLevel -0.174667 0.106976 -1.633 0.103
NumCompaniesWorked -0.019232 0.033118 -0.581 0.561
TrainingTimesLastYear -0.033477 0.056963 -0.588 0.557
YearsAtCompany -0.042311 0.027130 -1.560 0.119
YearsInCurrentRole 0.051974 0.033983 1.529 0.126
YearsSinceLastPromotion 0.016416 0.028931 0.567 0.570
YearsWithCurrManager 0.020660 0.033970 0.608 0.543

Threshold coefficients:
Estimate Std. Error z value
314 0.762 0.585 1.303
```

- Upon reviewing the correlation heatmap, we opted to explore the relationship between percent salary hike and performance rating, given their robust positive association ( $r = 0.77$ ).
- However, when we executed the model for percent salary hike and performance rating, we encountered a scenario where the maximum likelihood estimates of the coefficients became infinite due to quasi-complete separation.
- This arises from the observation that, for values of PercentSalaryHike less than or equal to 20, all instances exhibit a PerformanceRating equal to 4. This condition, known as quasi complete separation, which poses challenges in regression analysis

```
```{r}
table(data$PercentSalaryHike, data$PerformanceRating)
```


PercentSalaryHike	PerformanceRating	Count
3	4	1
11	210	0
12	198	0
13	209	0
14	201	0
15	101	0
16	78	0
17	82	0
18	89	0
19	76	0
20	0	55
21	0	48
22	0	56
23	0	28
24	0	21
25	0	18


```

# Conclusion to RQ3

---

- We fail to reject the null hypothesis i.e.) there is no significant relationship between environment satisfaction, job satisfaction, relationship satisfaction, work-life balance, and performance ratings.
- In addressing this issue, it's advisable to avoid using the Ordinary Least Squares (OLS) regression model, as it is not well-suited for situations involving quasi-complete separation. Consider alternative modeling approaches, such as logistic regression with regularization techniques (e.g., Firth's penalized likelihood) or other robust methods that handle separation issues more effectively.

# Limitations

---

## 1. Causation and Correlation Distinction:

- Statistical methods excel in identifying correlations between variables but lack the capacity to establish causation.
- Correlations, as seen between job role, job level do not inherently indicate a causal link resulting in increased/decreased monthly income.

## 2. Impact of Confounding Variables:

- Confounding variables, correlated with both independent and dependent variables, can introduce distortions into statistical results.

## 3. Influence of Biased Data:

- The accuracy of statistical analyses hinges on the quality of the data used.
- Biased or incomplete data may yield results that do not faithfully represent the true relationship between variables.

## 4. Predictive Limitations at Extremes:

- Making predictions for values of the explanatory variable slightly larger than the minimum or smaller than the maximum can be precarious.
- Sparse observations near the minimum or maximum values of the explanatory variable in many datasets may compromise the reliability of predictions in these extreme ranges.

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