Skills-for-care analysis ARNOVA 2023

Meng Ye

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# environment setup to run ordered logit properly  
options(contrasts = rep("contr.treatment", 2))

This chunk loads all the packages to use

#packages for ordered logit  
library(tidyverse) # package for data cleaning and plotting  
library(readxl) # package for reading excel file  
library(broom) # extracting model summary as data frame  
library(modelsummary) # deriving model tables  
library(scales) # label percent  
library(lubridate) # working with dates  
library(marginaleffects) #to calculate marginal effects  
library(ordinal) # package for ordinal logit regression  
library(here) # specifying directory

## Data Preparation

First, import the sampled and coded data set

#import the raw data file  
cqc\_skills <- read\_csv(here("data","cleaned\_sfc\_ipw.csv")) %>%   
 mutate(form = fct\_relevel(form, "FPO"),  
 rating = factor(rating),  
 Year = factor(year),  
 during\_covid = after\_covid,  
 staff\_level = staff\_level/100) %>%   
 mutate(rating = ordered(rating, levels = c("Inadequate","Req improv", "Good", "Outstanding"))) %>%   
 filter(form!="NA" & rating!="NA")

## Detailes about new variables

* About turnover rate

Employee turnover rate is the percent of employees who leave a company within a specific time period. Turnover rate is commonly calculated by month, quarter, or year and includes both voluntary and involuntary losses.

## Modeling on rating with staff control

model\_order <- clm(rating ~ form + category + region + during\_covid,  
 data = filter(cqc\_skills, domain == "Overall"),  
 link = "logit")  
  
model\_order\_weighted <- clm(rating ~ form + category + region + during\_covid,  
 data = filter(cqc\_skills, domain == "Overall"),  
 link = "logit",  
 weights = ipw)  
  
model\_order\_weighted2 <- clm(rating ~ form + category + region + during\_covid,  
 data = filter(cqc\_skills, domain == "Overall"),  
 link = "logit",  
 weights = ipw\_short)  
  
  
model\_staff <- lm(staff\_level ~ form + category + region + during\_covid,  
 data = filter(cqc\_skills, domain == "Overall"))  
  
model\_staff\_weighted <- lm(staff\_level ~ form + category + region + during\_covid,  
 data = filter(cqc\_skills, domain == "Overall"),  
 weights = ipw)  
  
staff\_direct\_order <- clm(rating ~ form + staff\_level + category + region + during\_covid,  
 data = filter(cqc\_skills, domain == "Overall"),  
 link = "logit")  
staff\_direct\_order\_weighted <- clm(rating ~ form + staff\_level + category + region + during\_covid,  
 data = filter(cqc\_skills, domain == "Overall"),  
 link = "logit",  
 weights = ipw)

staff\_models <- modelsummary(list("full" = model\_order, "full weighted" = model\_order\_weighted,   
 "full weighted 2" = model\_order\_weighted2,   
 "staffing" = model\_staff, "staffing weighted"= model\_staff\_weighted,   
 "direct" = staff\_direct\_order, "direct weighted" = staff\_direct\_order\_weighted),  
 coef\_omit = "region", exponentiate = F,  
 statistic = "({p.value}) {stars}")  
staff\_models

|  | full | full weighted | full weighted 2 | staffing | staffing weighted | direct | direct weighted |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Inadequate|Req improv | -5.830 | -5.584 | -5.561 |  |  | -5.782 | -5.544 |
|  | (<0.001) \*\*\* | (<0.001) \*\*\* | (<0.001) \*\*\* |  |  | (<0.001) \*\*\* | (<0.001) \*\*\* |
| Req improv|Good | -2.862 | -2.732 | -2.719 |  |  | -2.820 | -2.703 |
|  | (<0.001) \*\*\* | (<0.001) \*\*\* | (<0.001) \*\*\* |  |  | (<0.001) \*\*\* | (<0.001) \*\*\* |
| Good|Outstanding | 2.383 | 2.521 | 2.522 |  |  | 2.419 | 2.555 |
|  | (<0.001) \*\*\* | (<0.001) \*\*\* | (<0.001) \*\*\* |  |  | (<0.001) \*\*\* | (<0.001) \*\*\* |
| formCIC | 0.368 | 0.348 | 0.376 | 0.584 | 0.547 | 0.284 | 0.241 |
|  | (0.336) | (0.244) | (0.205) | (0.043) \* | (0.075) + | (0.480) | (0.445) |
| formGOV | 0.125 | 0.264 | 0.276 | 0.783 | 0.785 | 0.006 | 0.134 |
|  | (0.391) | (0.054) + | (0.044) \* | (<0.001) \*\*\* | (<0.001) \*\*\* | (0.966) | (0.344) |
| formIND | -0.184 | -0.249 | -0.221 | -0.179 | -0.180 | -0.128 | -0.189 |
|  | (0.259) | (0.008) \*\* | (0.018) \* | (0.168) | (0.084) + | (0.464) | (0.061) + |
| formNPO | 0.273 | 0.336 | 0.344 | 0.572 | 0.571 | 0.215 | 0.269 |
|  | (0.001) \*\* | (<0.001) \*\*\* | (<0.001) \*\*\* | (<0.001) \*\*\* | (<0.001) \*\*\* | (0.018) \* | (<0.001) \*\*\* |
| categoryresidential | -0.491 | -0.472 | -0.480 | 0.462 | 0.473 | -0.543 | -0.538 |
|  | (<0.001) \*\*\* | (<0.001) \*\*\* | (<0.001) \*\*\* | (<0.001) \*\*\* | (<0.001) \*\*\* | (<0.001) \*\*\* | (<0.001) \*\*\* |
| during\_covidTRUE | -1.687 | -1.789 | -1.785 | -0.169 | -0.166 | -1.665 | -1.771 |
|  | (<0.001) \*\*\* | (<0.001) \*\*\* | (<0.001) \*\*\* | (0.004) \*\* | (0.003) \*\* | (<0.001) \*\*\* | (<0.001) \*\*\* |
| (Intercept) |  |  |  | 1.300 | 1.283 |  |  |
|  |  |  |  | (<0.001) \*\*\* | (<0.001) \*\*\* |  |  |
| staff\_level |  |  |  |  |  | 0.048 | 0.058 |
|  |  |  |  |  |  | (0.005) \*\* | (<0.001) \*\*\* |
| Num.Obs. | 6504 | 12933 | 12941 | 5767 | 5767 | 5767 | 11430 |
| R2 |  |  |  | 0.037 | 0.036 |  |  |
| R2 Adj. |  |  |  | 0.035 | 0.033 |  |  |
| AIC | 7518.8 | 15461.8 | 15516.9 | 24025.6 | 23772.0 | 6650.4 | 13575.8 |
| BIC | 7634.1 | 15588.7 | 15643.9 | 24132.2 | 23878.5 | 6770.3 | 13708.0 |
| Log.Lik. |  |  |  | -11996.820 | -11869.988 |  |  |
| RMSE | 2.27 | 2.27 | 2.27 | 1.94 | 1.94 | 2.27 | 2.28 |

# Modeling on rating with turnover

model\_turnover <- lm(turnover ~ form + category + region + during\_covid,  
 data = filter(cqc\_skills, domain == "Overall"))  
  
model\_turnover\_weighted <- lm(turnover ~ form + category + region + during\_covid,  
 data = filter(cqc\_skills, domain == "Overall"),  
 weights = ipw)  
  
turnover\_direct\_order <- clm(rating ~ form + turnover + category + region + during\_covid,  
 data = filter(cqc\_skills, domain == "Overall"),  
 link = "logit")  
turnover\_direct\_order\_weighted <- clm(rating ~ form + turnover + category + region + during\_covid,  
 data = filter(cqc\_skills, domain == "Overall"),  
 link = "logit",  
 weights = ipw)

staff\_models <- modelsummary(list("full" = model\_order, "full weighted" = model\_order\_weighted,   
 "turnover" = model\_turnover, "turnover weighted"= model\_turnover\_weighted,   
 "direct" = turnover\_direct\_order, "direct weighted" = turnover\_direct\_order\_weighted),  
 coef\_omit = "region", exponentiate = F,  
 statistic = "({p.value}) {stars}")  
staff\_models

|  | full | full weighted | turnover | turnover weighted | direct | direct weighted |
| --- | --- | --- | --- | --- | --- | --- |
| Inadequate|Req improv | -5.830 | -5.584 |  |  | -5.964 | -5.733 |
|  | (<0.001) \*\*\* | (<0.001) \*\*\* |  |  | (<0.001) \*\*\* | (<0.001) \*\*\* |
| Req improv|Good | -2.862 | -2.732 |  |  | -2.916 | -2.809 |
|  | (<0.001) \*\*\* | (<0.001) \*\*\* |  |  | (<0.001) \*\*\* | (<0.001) \*\*\* |
| Good|Outstanding | 2.383 | 2.521 |  |  | 2.366 | 2.489 |
|  | (<0.001) \*\*\* | (<0.001) \*\*\* |  |  | (<0.001) \*\*\* | (<0.001) \*\*\* |
| formCIC | 0.368 | 0.348 | -5.100 | -5.935 | 0.219 | 0.130 |
|  | (0.336) | (0.244) | (0.501) | (0.486) | (0.683) | (0.756) |
| formGOV | 0.125 | 0.264 | -19.803 | -20.050 | 0.065 | 0.199 |
|  | (0.391) | (0.054) + | (<0.001) \*\*\* | (<0.001) \*\*\* | (0.670) | (0.157) |
| formIND | -0.184 | -0.249 | -11.525 | -11.785 | -0.165 | -0.248 |
|  | (0.259) | (0.008) \*\* | (<0.001) \*\*\* | (<0.001) \*\*\* | (0.376) | (0.021) \* |
| formNPO | 0.273 | 0.336 | -7.255 | -7.369 | 0.260 | 0.315 |
|  | (0.001) \*\* | (<0.001) \*\*\* | (<0.001) \*\*\* | (<0.001) \*\*\* | (0.010) \*\* | (<0.001) \*\*\* |
| categoryresidential | -0.491 | -0.472 | -5.656 | -6.003 | -0.561 | -0.554 |
|  | (<0.001) \*\*\* | (<0.001) \*\*\* | (<0.001) \*\*\* | (<0.001) \*\*\* | (<0.001) \*\*\* | (<0.001) \*\*\* |
| during\_covidTRUE | -1.687 | -1.789 | 3.175 | 3.249 | -1.642 | -1.754 |
|  | (<0.001) \*\*\* | (<0.001) \*\*\* | (0.012) \* | (0.011) \* | (<0.001) \*\*\* | (<0.001) \*\*\* |
| (Intercept) |  |  | 35.652 | 35.499 |  |  |
|  |  |  | (<0.001) \*\*\* | (<0.001) \*\*\* |  |  |
| turnover |  |  |  |  | -0.001 | -0.001 |
|  |  |  |  |  | (0.248) | (0.127) |
| Num.Obs. | 6504 | 12933 | 4939 | 4939 | 4939 | 9774 |
| R2 |  |  | 0.031 | 0.026 |  |  |
| R2 Adj. |  |  | 0.029 | 0.023 |  |  |
| AIC | 7518.8 | 15461.8 | 50234.9 | 50613.3 | 5599.5 | 11414.2 |
| BIC | 7634.1 | 15588.7 | 50339.0 | 50717.3 | 5716.6 | 11543.5 |
| Log.Lik. |  |  | -25101.448 | -25290.627 |  |  |
| RMSE | 2.27 | 2.27 | 38.99 | 38.99 | 2.27 | 2.27 |