ENPOVE

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# 1 Set global knitr options

# 2 Load packages

pacman::p\_load(rio,  
 here,  
 tidyverse,  
 finalfit,  
 survey,  
 gtsummary,  
 broom,  
 car,  
 MASS,   
 VGAM,  
 nnet,  
 purrr,  
 sjPlot)

# gtsummary themes

# 3 Import data

enpove <- import(here("data", "basefinal-enpove.dta"))  
enpove <- janitor::clean\_names(enpove) #standardize the syntax of column names

# 4 Process data

## 4.1 Recode and relevel dataset

# Select variables  
data <- enpove |>  
 dplyr::select(insecat, estrato, alquilaviv, p204, edadcat, p402, p601, p501,   
 p501b, p501a, necalimsalud, sitmigratoria, residencia, p410,   
 estadocivil, factorfinal)  
  
# Recode, relevel, and relabel  
data\_clear <- data |>  
 mutate(NIVEL\_EDUCATIVO = case\_when(p501b == 1 ~ "No formal education or primary",  
 p501b == 2 ~ "No formal education or primary",  
 p501b == 3 ~ "No formal education or primary",  
 p501b == 4 ~ "No formal education or primary",  
 p501b == 5 ~ "No formal education or primary",  
 p501b == 6 ~ "Secondary",  
 p501b == 8 ~ "Secondary",  
 p501b == 9 ~ "Higher",  
 p501b == 10 ~ "Secondary",  
 p501b == 11 ~ "Higher",  
 p501b == 12 ~ "Higher",  
 p501 == 1 ~ "No formal education or primary",  
 p501 == 2 ~ "No formal education or primary",  
 p501 == 3 ~ "No formal education or primary",  
 p501 == 4 ~ "No formal education or primary",  
 p501 == 5 ~ "No formal education or primary",  
 p501 == 6 ~ "Secondary",  
 p501 == 7 ~ "Secondary",  
 p501 == 8 ~ "Higher",  
 p501 == 9 ~ "Secondary",  
 p501 == 10 ~ "Higher",  
 p501 == 11 ~ "Higher",  
 p501a == 3 ~ "No formal education or primary")) |>  
   
 mutate(sexo = factor(p204) |>  
 fct\_recode("Male" = "1",  
 "Female" = "2") |>  
 fct\_relevel("Male", "Female") |>  
 ff\_label("Sex"),  
   
 edad = factor(edadcat) |>  
 fct\_recode("18 to 25" = "1",  
 "26 to 35" = "2",  
 "36 to 50" = "3",  
 "50 to 65" = "4",  
 ">65" = "5") |>  
 fct\_relevel("18 to 25", "26 to 35", "36 to 50", "50 to 65", ">65") |>  
 ff\_label("Age (years)"),  
   
 estrato = factor(estrato) |>  
 fct\_recode("Low" = "1",  
 "Medium" = "2",  
 "Medium" = "3",  
 "High" = "4",  
 "High" = "5") |>  
 fct\_relevel("High", "Medium", "Low") |>  
 ff\_label("Socioeconomic status"),  
   
 educacion = factor(NIVEL\_EDUCATIVO) |>  
 fct\_relevel("Higher", "Secondary", "No formal education or primary") |>  
 ff\_label("Educational level"),  
   
 estadocivil = factor(estadocivil) |>  
 fct\_recode("Single" = "0",  
 "With a partner" = "1") |>  
 fct\_relevel("Single", "With a partner") |>  
 ff\_label("Marital status"),  
   
 sitmigratoria = factor(sitmigratoria) |>  
 fct\_recode("Legal" = "0",  
 "Illegal" = "1") |>  
 fct\_relevel("Legal", "Illegal") |>  
 ff\_label("Migratory status"),  
   
 residencia = factor(residencia) |>  
 fct\_recode("0-6" = "1",  
 "7-12" = "2",  
 "13-24" = "3",  
 ">24" = "4") |>  
 fct\_relevel(">24", "13-24", "7-12", "0-6") |>  
 ff\_label("Residence (months)"),  
   
 vivienda = factor(alquilaviv) |>  
 fct\_recode("Own" = "0",  
 "Rented" = "1") |>  
 fct\_relevel("Own", "Rented") |>  
 ff\_label("Housing"),  
   
 enf\_cronica = factor(p402) |>  
 fct\_recode("Yes" = "1",  
 "No" = "2") |>  
 fct\_relevel("Yes", "No") |>  
 ff\_label("Chronic disease"),  
   
 seguro = factor(necalimsalud) |>  
 fct\_recode("Yes" = "0",  
 "No" = "1") |>  
 fct\_relevel("Yes", "No") |>  
 ff\_label("Health insurance"),  
   
 COVID19 = factor(p410) |>  
 fct\_recode("Current" = "1",  
 "Previously" = "2",  
 "No" = "3",  
 "Do not know" = "4") |>  
 fct\_relevel("No", "Current", "Previously", "Do not know") |>  
 ff\_label("COVID-19"),   
   
 trabajo = factor(p601) |>  
 fct\_recode("Yes" = "1",  
 "No" = "2") |>  
 fct\_relevel("Yes", "No") |>  
 ff\_label("Economic income"),  
   
 FIES = factor(insecat) |>  
 fct\_recode("No" = "0",  
 "Slight" = "1",  
 "Moderate" = "2",  
 "Severe" = "3") |>  
 fct\_relevel("No", "Slight", "Moderate", "Severe") |>  
 ff\_label("FIES")  
 ) |>  
   
 # Select variables  
 dplyr::select(sexo, edad, estrato, educacion, estadocivil, sitmigratoria,   
 residencia, vivienda, enf\_cronica, seguro, COVID19, trabajo,   
 FIES, factorfinal)

## 4.2 Exploratory Data Analysis (EDA)

# Structure  
glimpse(data\_clear)  
  
# Unique values  
lapply(data\_clear, function(x) unique(x))  
  
# Missing values  
lapply(data\_clear, function(x) sum(is.na(x)))  
lapply(data\_clear, function(x) sum(complete.cases(x)))  
  
# Tables  
lapply(data\_clear[1:13], function(x) table(x))

# 5 Produce outputs

## 5.1 Design and Study Population

This study conducted an secondary analysis on data from the 2022 Venezuelan Population Residing in Peru Survey (ENPOVE 2022 - acronym in Spanish). This second survey was carried out by the National Institute of Statistics and Informatics (INEI - acronym in Spanish) during February and March 2022. The survey contains information on the demographic, social, economic, health status, vulnerability and protection needs of the Venezuelan refugee and migrant population in Peru. For further information on sample design, procedures and data collection, consult the ENPOVE 2022 data sheet and report (Instituto Nacional de Estadística e Informática 2022a) (Instituto Nacional de Estadística e Informática 2022b).

The total sample size of the ENPOVE 2022 was 3,680 households with a total of 12,487 participants. The sample selection was probabilistic, stratified, and independent in 8 provincial capitals: Tumbes, Piura, Chiclayo, Trujillo, Chimbote, Ica, Arequipa, Lima and Callao, as these cities concentrate 195,710 households, which represented 82.9% of the total number of households with Venezuelan migrant and refugee population at the national level (Instituto Nacional de Estadística e Informática 2022b).

## 5.2 Variables and Measurements

### 5.2.1 Individual food insecurity

The primary outcome in this study was food insecurity, which was measured using the Food Insecurity Experience Scale (FIES), this is a metric of severity of food insecurity at the household or individual level composed of eight questions with dichotomous (“yes”/“no”) responses, also have eligible modules depending on the response unit and reference period (30 days or 12 months). This statistical measurement scale is an one-dimensional measure using the Rasch model and

(Cafiero, Viviani, and Nord 2018)

### 5.2.2 Explanatory variables

## 5.3 Statistical analysis

## 5.4 Ethical considerations

## 5.5 Characteristics of Venezuelan adults living in Peru

In this subsection we use tbl\_summary() to make the unweighted descriptive analysis,

### 5.5.1 Unweighted descriptive table

data\_clear |>  
 tbl\_summary(percent = "column", include = c(sexo:FIES),  
 statistic = list(all\_categorical() ~ "{n} ({p})"),  
 type = all\_categorical() ~ "categorical",  
 digits = all\_categorical() ~ c(0, 1),  
 missing\_text = "(Missing)") |>  
 bold\_labels() |>  
 add\_ci(statistic = list(all\_categorical() ~ "{conf.low} - {conf.high}"),   
 style\_fun = list(all\_categorical() ~ purrr::partial(style\_percent, digits = 1))) |>  
 modify\_caption("Table S1. Characteristics of Venezuelan adults living in Peru (N = {N})")

Table S1. Characteristics of Venezuelan adults living in Peru (N = 7727)

| **Characteristic** | **N = 7,727** | **95% CI**1 |
| --- | --- | --- |
| **Sex, n (%)** |  |  |
| Male | 3,737 (48.4) | 47.2 - 49.5 |
| Female | 3,990 (51.6) | 50.5 - 52.8 |
| **Age (years), n (%)** |  |  |
| 18 to 25 | 1,945 (25.2) | 24.2 - 26.2 |
| 26 to 35 | 3,006 (38.9) | 37.8 - 40.0 |
| 36 to 50 | 1,941 (25.1) | 24.2 - 26.1 |
| 50 to 65 | 701 (9.1) | 8.45 - 9.74 |
| >65 | 134 (1.7) | 1.46 - 2.06 |
| **Socioeconomic status, n (%)** |  |  |
| High | 1,671 (21.6) | 20.7 - 22.6 |
| Medium | 5,141 (66.5) | 65.5 - 67.6 |
| Low | 915 (11.8) | 11.1 - 12.6 |
| **Educational level, n (%)** |  |  |
| Higher | 2,250 (29.1) | 28.1 - 30.1 |
| Secondary | 3,479 (45.0) | 43.9 - 46.1 |
| No formal education or primary | 1,998 (25.9) | 24.9 - 26.9 |
| **Marital status, n (%)** |  |  |
| Single | 2,769 (35.8) | 34.8 - 36.9 |
| With a partner | 4,958 (64.2) | 63.1 - 65.2 |
| **Migratory status, n (%)** |  |  |
| Legal | 4,866 (63.0) | 61.9 - 64.1 |
| Illegal | 2,861 (37.0) | 35.9 - 38.1 |
| **Residence (months), n (%)** |  |  |
| >24 | 5,866 (75.9) | 74.9 - 76.9 |
| 13-24 | 656 (8.5) | 7.88 - 9.14 |
| 7-12 | 434 (5.6) | 5.12 - 6.16 |
| 0-6 | 771 (10.0) | 9.32 - 10.7 |
| **Housing, n (%)** |  |  |
| Own | 476 (6.2) | 5.64 - 6.73 |
| Rented | 7,251 (93.8) | 93.3 - 94.4 |
| **Chronic disease, n (%)** |  |  |
| Yes | 1,334 (17.3) | 16.4 - 18.1 |
| No | 6,393 (82.7) | 81.9 - 83.6 |
| **Health insurance, n (%)** |  |  |
| Yes | 903 (11.7) | 11.0 - 12.4 |
| No | 6,824 (88.3) | 87.6 - 89.0 |
| **COVID-19, n (%)** |  |  |
| No | 4,708 (60.9) | 59.8 - 62.0 |
| Current | 99 (1.3) | 1.05 - 1.56 |
| Previously | 2,277 (29.5) | 28.5 - 30.5 |
| Do not know | 643 (8.3) | 7.72 - 8.96 |
| **Economic income, n (%)** |  |  |
| Yes | 5,830 (75.4) | 74.5 - 76.4 |
| No | 1,897 (24.6) | 23.6 - 25.5 |
| **FIES, n (%)** |  |  |
| No | 394 (5.1) | 4.62 - 5.62 |
| Slight | 3,632 (47.0) | 45.9 - 48.1 |
| Moderate | 2,850 (36.9) | 35.8 - 38.0 |
| Severe | 851 (11.0) | 10.3 - 11.7 |
| 1CI = Confidence Interval | | |

### 5.5.2 Expansion factor weighted descriptive table

Use the show\_header\_names() to see the column names that can be modified

tbl\_svysummary <-  
 survey::svydesign(ids = ~1,   
 data = data\_clear,   
 weights = ~factorfinal) |>  
 tbl\_svysummary(percent = "column", include = c(sexo:FIES),   
 statistic = list(all\_categorical() ~ "{n\_unweighted} ({p})"),  
 type = all\_categorical() ~ "categorical",  
 digits = all\_categorical() ~ c(0, 1),  
 missing\_text = "(Missing)") |>  
 add\_ci(method = list(all\_categorical() ~ "svyprop.logit"),  
 statistic = list(all\_categorical() ~ "{conf.low} - {conf.high}"),  
 style\_fun = list(all\_categorical() ~ purrr::partial(style\_percent, digits = 1))) |>  
 bold\_labels() |>  
 modify\_column\_alignment(columns = everything(), align = "left") |>  
 modify\_caption("Table 1. Characteristics of Venezuelan adults living in Peru (N = 7727)") |>  
 modify\_header(label = "\*\*Characteristic\*\*",   
 stat\_0 ~ "\*\*n (%)\*\*",   
 ci\_stat\_0 = "\*\*95% CI\*\*") |>  
 modify\_spanning\_header(c("stat\_0", "ci\_stat\_0") ~ "\*\*Weighted proportion\*\*") |>  
 modify\_footnote(stat\_0 ~ "n (%) = count unweighted (weighted percentage)")  
tbl\_svysummary

Table 1. Characteristics of Venezuelan adults living in Peru (N = 7727)

|  | **Weighted proportion** | |
| --- | --- | --- |
| **Characteristic** | **n (%)**1 | **95% CI**2 |
| **Sex** |  |  |
| Male | 3,737 (48.4) | 46.9 - 49.9 |
| Female | 3,990 (51.6) | 50.1 - 53.1 |
| **Age (years)** |  |  |
| 18 to 25 | 1,945 (23.7) | 22.5 - 25.0 |
| 26 to 35 | 3,006 (40.5) | 39.1 - 42.0 |
| 36 to 50 | 1,941 (25.3) | 24.1 - 26.6 |
| 50 to 65 | 701 (8.9) | 8.09 - 9.70 |
| >65 | 134 (1.6) | 1.33 - 1.96 |
| **Socioeconomic status** |  |  |
| High | 1,671 (23.7) | 22.4 - 25.0 |
| Medium | 5,141 (64.5) | 63.1 - 65.9 |
| Low | 915 (11.8) | 10.9 - 12.8 |
| **Educational level** |  |  |
| Higher | 2,250 (31.7) | 30.4 - 33.1 |
| Secondary | 3,479 (47.5) | 46.0 - 48.9 |
| No formal education or primary | 1,998 (20.8) | 19.7 - 22.0 |
| **Marital status** |  |  |
| Single | 2,769 (36.2) | 34.8 - 37.5 |
| With a partner | 4,958 (63.8) | 62.5 - 65.2 |
| **Migratory status** |  |  |
| Legal | 4,866 (70.3) | 69.0 - 71.6 |
| Illegal | 2,861 (29.7) | 28.4 - 31.0 |
| **Residence (months)** |  |  |
| >24 | 5,866 (77.6) | 76.3 - 78.8 |
| 13-24 | 656 (8.4) | 7.60 - 9.26 |
| 7-12 | 434 (5.0) | 4.40 - 5.68 |
| 0-6 | 771 (9.0) | 8.24 - 9.87 |
| **Housing** |  |  |
| Own | 476 (5.3) | 4.69 - 5.99 |
| Rented | 7,251 (94.7) | 94.0 - 95.3 |
| **Chronic disease** |  |  |
| Yes | 1,334 (16.5) | 15.5 - 17.6 |
| No | 6,393 (83.5) | 82.4 - 84.5 |
| **Health insurance** |  |  |
| Yes | 903 (11.2) | 10.4 - 12.2 |
| No | 6,824 (88.8) | 87.8 - 89.6 |
| **COVID-19** |  |  |
| No | 4,708 (59.6) | 58.2 - 61.0 |
| Current | 99 (1.3) | 1.03 - 1.67 |
| Previously | 2,277 (31.4) | 30.0 - 32.8 |
| Do not know | 643 (7.7) | 6.94 - 8.48 |
| **Economic income** |  |  |
| Yes | 5,830 (76.4) | 75.1 - 77.6 |
| No | 1,897 (23.6) | 22.4 - 24.9 |
| **FIES** |  |  |
| No | 394 (5.5) | 4.87 - 6.16 |
| Slight | 3,632 (49.5) | 48.1 - 51.0 |
| Moderate | 2,850 (34.7) | 33.3 - 36.1 |
| Severe | 851 (10.3) | 9.45 - 11.2 |
| 1n (%) = count unweighted (weighted percentage) | | |
| 2CI = Confidence Interval | | |

### 5.5.3 Confirm with dplyr package

data\_clear |>  
 dplyr::select(sexo, edad, estrato, educacion, estadocivil, sitmigratoria, residencia,   
 vivienda, enf\_cronica, seguro, COVID19, trabajo, FIES, factorfinal) |>  
 pivot\_longer(cols = c(sexo:trabajo), names\_to = "Variable", values\_to = "Valor") |>  
 group\_by(Variable, Valor) |>  
 summarise(n = n(),  
 weighted\_prop = sum(factorfinal)) |>  
 mutate(weighted\_prop = round(weighted\_prop/sum(weighted\_prop)\*100, 2))

## 5.6 Characteristics of Venezuelan adults according to Food Insecurity Experience Scale (FIES)

Package survey and gtsummary are required.

### 5.6.1 Bivariate analysis

Chi-squared test with Rao & Scott’s second-order correction and Holm-Bonferroni method to adjust for multiple tests.

Use (García-Pérez 2023) to understand the goodness of fit

tbl\_svysummary\_1 <-  
 survey::svydesign(ids = ~1,   
 data = data\_clear,  
 weights = ~factorfinal) |>  
 tbl\_svysummary(by = FIES,   
 percent = "row",   
 include = c(sexo:FIES),   
 statistic = list(all\_categorical() ~ "{p}"),  
 type = all\_categorical() ~ "categorical",  
 digits = all\_categorical() ~ 2,  
 missing\_text = "(Missing)") |>  
 add\_ci(method = list(all\_categorical() ~ "svyprop.logit"),  
 statistic = list(all\_categorical() ~ "{conf.low} - {conf.high}"),  
 style\_fun = list(all\_categorical() ~ purrr::partial(style\_percent, digits = 2)),  
 conf.level = 0.95) |>  
 bold\_labels() |>  
 add\_p(pvalue\_fun = ~style\_pvalue(.x, digits = 3)) |>  
 add\_q(method = "holm") |>  
 bold\_p(t = 0.05) |>  
 modify\_column\_alignment(columns = everything(), align = "left") |>  
 modify\_caption("Table 2. Characteristics of Venezuelan adults according to FIES") |>  
 modify\_header(all\_stat\_cols() ~ "\*\*{level}\*\*, n = {n\_unweighted} ({style\_percent(p)}%)")  
tbl\_svysummary\_1

Table 2. Characteristics of Venezuelan adults according to FIES

| **Characteristic** | **No**, n = 394 (5.5%)1 | **95% CI**2 | **Slight**, n = 3632 (50%)1 | **95% CI**2 | **Moderate**, n = 2850 (35%)1 | **95% CI**2 | **Severe**, n = 851 (10%)1 | **95% CI**2 | **p-value**3 | **q-value**4 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sex** |  |  |  |  |  |  |  |  | 0.426 | 0.85 |
| Male | 5.35 | 41.29 - 53.20 | 50.71 | 47.49 - 51.67 | 33.65 | 44.54 - 49.36 | 10.29 | 43.70 - 52.86 |  |  |
| Female | 5.61 | 46.80 - 58.71 | 48.37 | 48.33 - 52.51 | 35.68 | 50.64 - 55.46 | 10.34 | 47.14 - 56.30 |  |  |
| **Age (years)** |  |  |  |  |  |  |  |  | 0.548 | 0.85 |
| 18 to 25 | 4.57 | 15.45 - 24.93 | 48.31 | 21.44 - 24.94 | 36.31 | 22.79 - 26.98 | 10.81 | 21.11 - 29.06 |  |  |
| 26 to 35 | 5.93 | 37.88 - 49.91 | 50.81 | 39.52 - 43.67 | 33.02 | 36.23 - 40.93 | 10.24 | 35.76 - 44.86 |  |  |
| 36 to 50 | 5.62 | 21.06 - 31.45 | 48.77 | 23.15 - 26.77 | 34.94 | 23.42 - 27.63 | 10.68 | 22.47 - 30.29 |  |  |
| 50 to 65 | 5.28 | 6.001 - 11.99 | 48.65 | 7.627 - 9.924 | 37.88 | 8.343 - 11.19 | 8.18 | 5.095 - 9.626 |  |  |
| >65 | 6.75 | 0.937 - 4.154 | 50.64 | 1.252 - 2.166 | 31.81 | 1.043 - 2.088 | 10.80 | 0.940 - 3.008 |  |  |
| **Socioeconomic status** |  |  |  |  |  |  |  |  | **<0.001** | <0.001 |
| High | 3.94 | 12.75 - 22.30 | 51.21 | 22.68 - 26.39 | 33.53 | 20.84 - 25.05 | 11.32 | 22.06 - 30.35 |  |  |
| Medium | 6.06 | 65.47 - 76.52 | 47.13 | 59.34 - 63.48 | 36.59 | 65.72 - 70.31 | 10.22 | 59.36 - 68.31 |  |  |
| Low | 5.43 | 8.419 - 16.01 | 59.10 | 12.64 - 15.65 | 26.68 | 7.790 - 10.53 | 8.79 | 7.577 - 13.22 |  |  |
| **Educational level** |  |  |  |  |  |  |  |  | **<0.001** | <0.001 |
| Higher | 6.33 | 31.07 - 42.55 | 54.54 | 32.99 - 36.99 | 31.16 | 26.33 - 30.77 | 7.98 | 20.83 - 28.69 |  |  |
| Secondary | 5.81 | 44.33 - 56.32 | 49.04 | 44.93 - 49.12 | 34.52 | 44.82 - 49.65 | 10.62 | 44.30 - 53.47 |  |  |
| No formal education or primary | 3.44 | 9.648 - 17.41 | 42.88 | 16.51 - 19.62 | 40.50 | 22.32 - 26.33 | 13.18 | 22.85 - 30.67 |  |  |
| **Marital status** |  |  |  |  |  |  |  |  | **0.019** | 0.058 |
| Single | 5.61 | 31.44 - 42.98 | 46.81 | 32.24 - 36.18 | 35.87 | 35.09 - 39.71 | 11.71 | 36.59 - 45.62 |  |  |
| With a partner | 5.41 | 57.02 - 68.56 | 51.03 | 63.82 - 67.76 | 34.03 | 60.29 - 64.91 | 9.53 | 54.38 - 63.41 |  |  |
| **Migratory status** |  |  |  |  |  |  |  |  | **<0.001** | <0.001 |
| Legal | 6.43 | 77.69 - 86.38 | 52.14 | 72.16 - 75.81 | 32.96 | 64.50 - 68.97 | 8.47 | 53.19 - 62.16 |  |  |
| Illegal | 3.24 | 13.62 - 22.31 | 43.28 | 24.19 - 27.84 | 38.81 | 31.03 - 35.50 | 14.67 | 37.84 - 46.81 |  |  |
| **Residence (months)** |  |  |  |  |  |  |  |  | **<0.001** | <0.001 |
| >24 | 6.09 | 81.28 - 90.03 | 50.65 | 77.63 - 81.02 | 33.98 | 73.84 - 77.99 | 9.27 | 65.37 - 73.80 |  |  |
| 13-24 | 5.09 | 4.888 - 12.20 | 45.11 | 6.601 - 8.849 | 34.56 | 7.092 - 9.836 | 15.24 | 9.487 - 16.07 |  |  |
| 7-12 | 2.77 | 1.022 - 6.100 | 46.52 | 3.870 - 5.698 | 37.78 | 4.449 - 6.648 | 12.93 | 4.521 - 8.637 |  |  |
| 0-6 | 2.10 | 2.108 - 5.614 | 45.38 | 7.212 - 9.469 | 39.29 | 8.848 - 11.77 | 13.23 | 9.053 - 14.68 |  |  |
| **Housing** |  |  |  |  |  |  |  |  | **<0.001** | 0.001 |
| Own | 8.52 | 5.217 - 12.79 | 58.80 | 5.313 - 7.449 | 23.34 | 2.886 - 4.399 | 9.34 | 3.338 - 6.866 |  |  |
| Rented | 5.31 | 87.21 - 94.78 | 48.99 | 92.55 - 94.69 | 35.33 | 95.60 - 97.11 | 10.37 | 93.13 - 96.66 |  |  |
| **Chronic disease** |  |  |  |  |  |  |  |  | **0.003** | 0.013 |
| Yes | 4.58 | 10.15 - 18.59 | 44.44 | 13.43 - 16.40 | 39.90 | 17.22 - 20.99 | 11.08 | 14.72 - 21.29 |  |  |
| No | 5.66 | 81.41 - 89.85 | 50.51 | 83.60 - 86.57 | 33.67 | 79.01 - 82.78 | 10.16 | 78.71 - 85.28 |  |  |
| **Health insurance** |  |  |  |  |  |  |  |  | **<0.001** | <0.001 |
| Yes | 7.20 | 10.97 - 19.60 | 73.35 | 15.18 - 18.25 | 15.82 | 4.223 - 6.208 | 3.63 | 2.489 - 6.246 |  |  |
| No | 5.26 | 80.40 - 89.03 | 46.49 | 81.75 - 84.82 | 37.09 | 93.79 - 95.78 | 11.16 | 93.75 - 97.51 |  |  |
| **COVID-19** |  |  |  |  |  |  |  |  | **0.005** | 0.021 |
| No | 5.01 | 48.40 - 60.47 | 48.72 | 56.59 - 60.74 | 35.41 | 58.49 - 63.17 | 10.86 | 58.22 - 67.09 |  |  |
| Current | 11.15 | 1.376 - 5.137 | 50.63 | 0.935 - 1.932 | 31.24 | 0.802 - 1.746 | 6.98 | 0.361 - 2.179 |  |  |
| Previously | 6.59 | 31.87 - 43.96 | 49.86 | 29.68 - 33.61 | 33.09 | 27.79 - 32.18 | 10.45 | 27.64 - 36.30 |  |  |
| Do not know | 3.65 | 3.297 - 7.812 | 53.96 | 7.246 - 9.629 | 36.30 | 6.825 - 9.415 | 6.10 | 3.177 - 6.438 |  |  |
| **Economic income** |  |  |  |  |  |  |  |  | **<0.001** | <0.001 |
| Yes | 5.47 | 70.56 - 81.05 | 51.42 | 77.59 - 80.99 | 33.60 | 71.79 - 76.05 | 9.51 | 66.11 - 74.42 |  |  |
| No | 5.53 | 18.95 - 29.44 | 43.31 | 19.01 - 22.41 | 38.25 | 23.95 - 28.21 | 12.91 | 25.58 - 33.89 |  |  |
| 1% | | | | | | | | | | |
| 2CI = Confidence Interval | | | | | | | | | | |
| 3chi-squared test with Rao & Scott's second-order correction | | | | | | | | | | |
| 4Holm correction for multiple testing | | | | | | | | | | |

### 5.6.2 Confirm with dplyr package

# one by one  
data\_clear |>  
 dplyr::select(sexo, edad, estrato, educacion, estadocivil, sitmigratoria, residencia,   
 vivienda, enf\_cronica, seguro, COVID19, trabajo, FIES, factorfinal) |>  
 group\_by(FIES) |>  
 summarise(n = n(),  
 weighted\_prop = sum(factorfinal)) |>  
 mutate(weighted\_prop = round(weighted\_prop/sum(weighted\_prop)\*100, 2))  
  
# whole  
data\_clear |>  
 dplyr::select(sexo, edad, estrato, educacion, estadocivil, sitmigratoria, residencia,   
 vivienda, enf\_cronica, seguro, COVID19, trabajo, FIES, factorfinal) |>  
 pivot\_longer(cols = c(sexo:trabajo), names\_to = "Variable", values\_to = "Valor") %>%  
 group\_by(Variable, Valor, FIES) %>%  
 summarise(n = n(),  
 weighted\_prop = sum(factorfinal)) |>  
 mutate(weighted\_prop = round(weighted\_prop/sum(weighted\_prop)\*100, 2))  
  
# Create a vector of independent variable names  
independent\_vars <- c("sexo", "edad", "estrato", "educacion", "estadocivil", "sitmigratoria",   
 "residencia", "vivienda", "enf\_cronica", "seguro", "COVID19", "trabajo")  
  
# Loop over the independent variables and perform chi-squared test  
lapply(data\_clear[, independent\_vars], function(x) chisq.test(data\_clear$FIES, x))

## 5.7 Unadjusted models

We performed unadjusted ordinal logistic regression models with proportional odds

### 5.7.1 Proportional odds logistic regression model with svyolr()

Let’s use svyolr() from survey package to fit cumulative link models, specifically proportional odds sample-weighted

design <- svydesign(ids = ~1, data = data\_clear, weights = ~factorfinal)  
  
univ\_tab <-  
 tbl\_uvregression(  
 data = design,  
 method = svyolr,  
 method.args = list(method = "logistic"),  
 include = c(sexo:trabajo),  
 y = FIES,  
 hide\_n = TRUE,  
 exponentiate = TRUE,  
 conf.int = TRUE,  
 ci\_method = "wald",  
 tidy\_fun = broom.helpers::tidy\_parameters,  
 add\_estimate\_to\_reference\_rows = FALSE,  
 pvalue\_fun = ~style\_pvalue(.x, digits = 3),  
 estimate\_fun = ~style\_number(.x, digits = 2)) |>  
 bold\_labels() |>  
 modify\_footnote(update = everything() ~ NA, abbreviation = TRUE)

### 5.7.2 Proportional odds logistic regression model with polr()

Let’s use polr() from MASS package to fit proportional odds logistic regression models sample-weighted. However, polr() function is supported by tbl\_regression(), but is not optimized for tbl\_uvregression(). Alternatively, it’s possible to create multiple univariate models using loops and a tidy tibble object by creating a function that includes tidy() from the broom package.

Using the function created is not possible to obtain p-values, so this test must be run using other functions such as dropterm(), drop1(), Anova() and lrtest(). It’s not feasible to extract the p-values to generate a new column and append it to the tidy tibble object. Although it is possible to extract the p-value using the $ or [row, column] operators, it varies considerably even after assigning the results to a tibble, data.frame, or list.

# tbl\_regression  
polr(FIES ~ sexo,   
 weights = factorfinal,  
 data = data\_clear,   
 Hess = TRUE,   
 method = "logistic") |>  
 tbl\_regression(exponentiate = TRUE,  
 conf.int = TRUE,  
 ci\_method = "wald",  
 tidy\_fun = broom.helpers::tidy\_parameters,  
 add\_estimate\_to\_reference\_rows = FALSE,  
 pvalue\_fun = ~style\_pvalue(.x, digits = 3),  
 estimate\_fun = ~style\_number(.x, digits = 2))  
  
# tidy  
  
## Univariate regression models  
exp1 <- polr(FIES ~ sexo, weights = factorfinal, data = data\_clear, Hess = TRUE, method = "logistic")  
exp2 <- polr(FIES ~ edad, weights = factorfinal, data = data\_clear, Hess = TRUE, method = "logistic")  
exp3 <- polr(FIES ~ estrato, weights = factorfinal, data = data\_clear, Hess = TRUE, method = "logistic")  
  
## Gathering models in a list  
polr\_results <- list(exp1, exp2, exp3)  
  
## Create loop function  
tidy\_table <- function(polr\_results) {  
 lapply(polr\_results, function(x) {  
 broom::tidy(x, conf.int = TRUE, exponentiate = TRUE) |>  
 dplyr::filter(coef.type == "coefficient") |> # Filter coefficients  
 dplyr::mutate(across(where(is.numeric), round, digits = 2))  
 })  
}  
  
## Run the function on the univariate regression models  
tidy\_table(list(exp1, exp2, exp3)) |>  
 bind\_rows()  
  
# p-values  
  
## Create loop function with drop1  
polr\_analysis <- function(polr\_results) {  
 drop1(polr\_results, test = "Chisq")  
}  
  
## Run the function on the univariate regression models  
lapply(polr\_results, polr\_analysis)  
  
## Short form  
lapply(polr\_results, function(x) drop1(x, test = "Chisq"))

### 5.7.3 Proportional odds logistic regression model with vglm

Let’s use vglm from VGAM package to fit proportional odds logistic regression models sample-weighted. VGAM::vglm has limited support by tbl\_regression() and tbl\_uvregression(). Instead, the functions summary(), coef(), confint(), and exp() can be used to extract the coefficients and their confidence intervals, but the sjPlot::tab\_model() function provides a better visualization.

univ\_vglm <- vglm(FIES ~ sexo, weights = factorfinal, data = data\_clear, family = propodds)  
tab\_model(univ\_vglm, show.intercept = F)

FIES

Predictors

Odds Ratios

CI

p

Sex: Female

1.06

1.05 – 1.07

<0.001

Observations

7727

### 5.7.4 Confirm the traditional way

# Select explanatory variables and weights  
data\_loop = data\_clear |>  
 dplyr::select(FIES, sexo, edad, estrato, educacion, estadocivil, sitmigratoria,   
 residencia, vivienda, enf\_cronica, COVID19, trabajo)  
  
weights = data\_clear$factorfinal  
  
# Loop to confirm results from svyolr  
lapply(colnames(data\_loop)[-1],   
 function(x) svyolr(as.formula(paste("FIES ~", x)), design = design) |>  
 coef() |>  
 exp())  
  
# Loop to confirm results from polr  
map(colnames(data\_loop)[-1],   
 ~ polr(as.formula(paste("FIES ~", .x)), weights = weights, data = data\_loop, method = "logistic") |>  
 coef() |>  
 exp() |>  
 tab\_model)

## 5.8 Adjusted model

### 5.8.1 Proportional odds logistic regression model with svyolr

design <- svydesign(ids = ~1, data = data\_clear, weights = ~factorfinal)  
  
mv\_tab <- svyolr(FIES ~ sexo + estrato + educacion + estadocivil + sitmigratoria +   
 residencia + vivienda + enf\_cronica + seguro + trabajo,   
 method = "logistic", design = design) |>   
 tbl\_regression(exponentiate = TRUE,  
 conf.int = TRUE,  
 tidy\_fun = broom.helpers::tidy\_parameters,  
 pvalue\_fun = ~style\_pvalue(.x, digits = 3),  
 estimate\_fun = ~style\_number(.x, digits = 2)) |>  
 add\_vif() |>  
 modify\_footnote(update = everything() ~ NA, abbreviation = TRUE)

### 5.8.2 Proportional odds logistic regression model with polr

mv\_tab\_polr <- polr(FIES ~ sexo + estrato + educacion + estadocivil + sitmigratoria +   
 residencia + vivienda + enf\_cronica + seguro + trabajo,   
 data = data\_clear, weights = factorfinal, Hess = TRUE, method = "logistic") |>  
 tbl\_regression(exponentiate = TRUE,   
 conf.int = TRUE,  
 tidy\_fun = broom.helpers::tidy\_parameters,  
 pvalue\_fun = ~style\_pvalue(.x, digits = 3),  
 estimate\_fun = ~style\_number(.x, digits = 2)) |>  
 add\_vif()  
mv\_tab\_polr

| **Characteristic** | **OR** **(95% CI)**1 | **p-value** | **GVIF**1 | **Adjusted GVIF**12 |
| --- | --- | --- | --- | --- |
| Sex |  |  | 1.2 | 1.1 |
| Male | — |  |  |  |
| Female | 0.95 (0.94 to 0.96) | <0.001 |  |  |
| Socioeconomic status |  |  | 1.0 | 1.0 |
| High | — |  |  |  |
| Medium | 1.04 (1.03 to 1.05) | <0.001 |  |  |
| Low | 0.84 (0.83 to 0.86) | <0.001 |  |  |
| Educational level |  |  | 1.1 | 1.0 |
| Higher | — |  |  |  |
| Secondary | 1.12 (1.11 to 1.14) | <0.001 |  |  |
| No formal education or primary | 1.37 (1.36 to 1.39) | <0.001 |  |  |
| Marital status |  |  | 1.0 | 1.0 |
| Single | — |  |  |  |
| With a partner | 0.87 (0.86 to 0.88) | <0.001 |  |  |
| Migratory status |  |  | 1.2 | 1.1 |
| Legal | — |  |  |  |
| Illegal | 1.42 (1.41 to 1.44) | <0.001 |  |  |
| Residence (months) |  |  | 1.2 | 1.0 |
| >24 | — |  |  |  |
| 13-24 | 1.14 (1.12 to 1.16) | <0.001 |  |  |
| 7-12 | 1.08 (1.06 to 1.10) | <0.001 |  |  |
| 0-6 | 1.18 (1.16 to 1.19) | <0.001 |  |  |
| Housing |  |  | 1.0 | 1.0 |
| Own | — |  |  |  |
| Rented | 1.36 (1.33 to 1.39) | <0.001 |  |  |
| Chronic disease |  |  | 1.1 | 1.0 |
| Yes | — |  |  |  |
| No | 0.85 (0.84 to 0.86) | <0.001 |  |  |
| Health insurance |  |  | 1.0 | 1.0 |
| Yes | — |  |  |  |
| No | 2.68 (2.64 to 2.72) | <0.001 |  |  |
| Economic income |  |  | 1.2 | 1.1 |
| Yes | — |  |  |  |
| No | 1.16 (1.15 to 1.17) | <0.001 |  |  |
| 1OR = Odds Ratio, CI = Confidence Interval, GVIF = Generalized Variance Inflation Factor | | | | |
| 2GVIF^[1/(2\*df)] | | | | |

### 5.8.3 Proportional odds logistic regression model with vglm

Alternatively, you can create a tibble object using the tidy() function, which is supported by vglm().

mv\_vglm <- vglm(FIES ~ sexo + estrato + educacion + estadocivil + sitmigratoria +   
 residencia + vivienda + enf\_cronica + seguro + trabajo,   
 data = data\_clear, weights = factorfinal, family = propodds)  
tab\_model(mv\_vglm, show.intercept = F)

FIES

Predictors

Odds Ratios

CI

p

Sex: Female

0.95

0.94 – 0.96

<0.001

Socioeconomic status:Medium

1.04

1.03 – 1.05

<0.001

Socioeconomic status: Low

0.84

0.83 – 0.86

<0.001

Educational level:Secondary

1.12

1.11 – 1.14

<0.001

Educational level: Noformal education orprimary

1.37

1.36 – 1.39

<0.001

Marital status: With apartner

0.87

0.86 – 0.88

<0.001

Migratory status: Illegal

1.42

1.41 – 1.44

<0.001

residencia13-24

1.14

1.12 – 1.16

<0.001

residencia7-12

1.08

1.06 – 1.10

<0.001

residencia0-6

1.18

1.16 – 1.20

<0.001

Housing: Rented

1.36

1.33 – 1.39

<0.001

Chronic disease: No

0.85

0.84 – 0.86

<0.001

Health insurance: No

2.68

2.64 – 2.72

<0.001

Economic income: No

1.16

1.15 – 1.17

<0.001

Observations

7727

fn\_tbl <-  
 gtsummary::tbl\_merge(tbls = list(univ\_tab, mv\_tab),  
 tab\_spanner = c("\*\*Unadjusted Analysis\*\*", "\*\*Adjusted Analysis\*\*")) |>  
 modify\_header(estimate\_1 = "\*\*cOR\*\* \*\*(95% CI)\*\*",  
 estimate\_2 = "\*\*aOR\*\* \*\*(95% CI)\*\*",  
 p.value\_1 = "\*\*p-value\*\*",  
 p.value\_2 = "\*\*p-value\*\*",  
 GVIF\_2 = "\*\*GVIF\*\*",  
 aGVIF\_2 = "\*\*aGVIF\*\*") |>  
 modify\_footnote(estimate\_1 = "cOR = Crude Odds Ratio, CI = Confidence Interval",  
 estimate\_2 = "aOR = Adjusted Odds Ratio, CI = Confidence Interval",  
 GVIF\_2 = "GVIF = Generalized Variance Inflation Factor",  
 aGVIF\_2 = "aVIF = Adjusted GVIF") |>  
 modify\_caption("Table 3. Factors associated with FIES by Ordinal Logistic Regression")  
fn\_tbl

Table 3. Factors associated with FIES by Ordinal Logistic Regression

|  | **Unadjusted Analysis** | | **Adjusted Analysis** | | | |
| --- | --- | --- | --- | --- | --- | --- |
| **Characteristic** | **cOR** **(95% CI)**1 | **p-value** | **aOR** **(95% CI)**2 | **p-value** | **GVIF**3 | **aGVIF**4 |
| **Sex** |  |  |  |  | 1.1 | 1.1 |
| Male | — |  | — |  |  |  |
| Female | 1.06 (0.95 to 1.18) | 0.297 | 0.95 (0.85 to 1.07) | 0.408 |  |  |
| **Age (years)** |  |  |  |  |  |  |
| 18 to 25 | — |  |  |  |  |  |
| 26 to 35 | 0.86 (0.74 to 0.99) | 0.036 |  |  |  |  |
| 36 to 50 | 0.93 (0.80 to 1.09) | 0.392 |  |  |  |  |
| 50 to 65 | 0.92 (0.75 to 1.12) | 0.393 |  |  |  |  |
| >65 | 0.83 (0.56 to 1.25) | 0.378 |  |  |  |  |
| **Socioeconomic status** |  |  |  |  | 1.1 | 1.0 |
| High | — |  | — |  |  |  |
| Medium | 1.00 (0.87 to 1.14) | >0.999 | 1.04 (0.90 to 1.19) | 0.609 |  |  |
| Low | 0.70 (0.57 to 0.85) | <0.001 | 0.84 (0.69 to 1.03) | 0.100 |  |  |
| **Educational level** |  |  |  |  | 1.2 | 1.0 |
| Higher | — |  | — |  |  |  |
| Secondary | 1.27 (1.12 to 1.44) | <0.001 | 1.12 (0.99 to 1.28) | 0.081 |  |  |
| No formal education or primary | 1.78 (1.54 to 2.07) | <0.001 | 1.37 (1.17 to 1.61) | <0.001 |  |  |
| **Marital status** |  |  |  |  | 1.0 | 1.0 |
| Single | — |  | — |  |  |  |
| With a partner | 0.86 (0.77 to 0.96) | 0.009 | 0.87 (0.77 to 0.98) | 0.021 |  |  |
| **Migratory status** |  |  |  |  | 1.3 | 1.1 |
| Legal | — |  | — |  |  |  |
| Illegal | 1.69 (1.50 to 1.91) | <0.001 | 1.42 (1.25 to 1.63) | <0.001 |  |  |
| **Residence (months)** |  |  |  |  | 1.2 | 1.0 |
| >24 | — |  | — |  |  |  |
| 13-24 | 1.38 (1.10 to 1.72) | 0.005 | 1.14 (0.91 to 1.44) | 0.258 |  |  |
| 7-12 | 1.41 (1.10 to 1.81) | 0.006 | 1.08 (0.84 to 1.39) | 0.537 |  |  |
| 0-6 | 1.51 (1.27 to 1.81) | <0.001 | 1.18 (0.98 to 1.41) | 0.081 |  |  |
| **Housing** |  |  |  |  | 1.1 | 1.0 |
| Own | — |  | — |  |  |  |
| Rented | 1.65 (1.28 to 2.12) | <0.001 | 1.36 (1.05 to 1.77) | 0.022 |  |  |
| **Chronic disease** |  |  |  |  | 1.1 | 1.0 |
| Yes | — |  | — |  |  |  |
| No | 0.78 (0.68 to 0.90) | <0.001 | 0.85 (0.73 to 0.98) | 0.029 |  |  |
| **Health insurance** |  |  |  |  | 1.1 | 1.0 |
| Yes | — |  | — |  |  |  |
| No | 2.92 (2.49 to 3.41) | <0.001 | 2.68 (2.28 to 3.14) | <0.001 |  |  |
| **COVID-19** |  |  |  |  |  |  |
| No | — |  |  |  |  |  |
| Current | 0.64 (0.39 to 1.04) | 0.074 |  |  |  |  |
| Previously | 0.89 (0.78 to 1.00) | 0.060 |  |  |  |  |
| Do not know | 0.85 (0.71 to 1.02) | 0.079 |  |  |  |  |
| **Economic income** |  |  |  |  | 1.1 | 1.1 |
| Yes | — |  | — |  |  |  |
| No | 1.35 (1.18 to 1.54) | <0.001 | 1.16 (1.01 to 1.34) | 0.041 |  |  |
| 1cOR = Crude Odds Ratio, CI = Confidence Interval | | | | | | |
| 2aOR = Adjusted Odds Ratio, CI = Confidence Interval | | | | | | |
| 3GVIF = Generalized Variance Inflation Factor | | | | | | |
| 4aVIF = Adjusted GVIF | | | | | | |

### 5.8.4 Multinomial logistic regression

# Save outputs

Cafiero, Carlo, Sara Viviani, and Mark Nord. 2018. “Food Security Measurement in a Global Context: The Food Insecurity Experience Scale.” *Measurement* 116 (February): 146–52. <https://doi.org/10.1016/j.measurement.2017.10.065>.

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———. 2022b. “Segunda Encuesta Dirigida a La Población Venezolana Que Reside En El País.” Lima, Peru. <https://www.inei.gob.pe/media/encuestas/documentos/enpove/Ficha_Tecnica_2022_enpove.pdf>.