CDC Health Care Employment 2000-2020

John Cruz

2023-02-28

Introduction

The Center for Disease Control and Prevention (CDC), through the National Center for Health Statistics (NCHS), released data about health care employment and wages within the United States between 2000-2020. The selected occupations range between two categories of *health care practitioners and technical* roles such as physician assistants and pharmacy technicians and *health care support* roles such as nursing assistants and psychiatric aides.

Employment figures are number of filled positions. This includes both full- and part-time wage and salary positions. Estimates do not include the self-employed, owners and partners in unincorporated firms, household workers, or unpaid family workers. This data excludes occupations such as dentists, physicians, and chiropractors, which have a large percentage of workers who are self-employed. Wages reported is calculated as a mean hourly wage rate for an occupation, where the total wages that all workers in the occupation earn in an hour divided by the total number of employees in the occupation.

Data Source: Table HCEmpl

After tidying up the Excel file into long format, the analysis will look to see if there is a relationship between the percentage change of employment versus the percentage change of mean hourly wages.

Required Libraries

```
library(tidyverse)
library(rio)
library(janitor)
```

Import Data

To import the data into R, the *rio* library allows it to read a URL that directly links to an Excel file and transform it into a data frame

```
url <- 'https://ftp.cdc.gov/pub/Health_Statistics/NCHS/Publications/Health_US/hus20-21tables/hcempl.xlsx'
data = import(url)

knitr::kable(head(data, 3))
```

Table HCEmpl. Health care employment and wages, by selected occupations: United States, selected years 2000–2020	...2	...3	...4	...5	...6	...7	...8	...9	...10	..11	..12	..13	..14	..15
Excel version (with more data years and standard errors when available): https://www.cdc.gov/nchs/hus/contents2020-2021.htm#Table-HCEmpl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
[Data are based on a semiannual survey of nonfarm establishments]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	Employment\1	NA	NA	NA	NA	NA	NA	Mean hourly wage (dollars)\2	NA	NA	NA	NA	NA	NA

Drop Non-Data Rows

Removing rows that does not provide figures from the table. Along with the *janitor* library, it can take a specific row and use it as the column headers, while also cleaning their names to a more appropriate syntax.

```
updated_data <-
  data |>
  filter(!row_number() %in% c(1:3, 49:51)) |>     # drop non-data rows
  row_to_names(row_number = 1) |>         # first row as column names
  clean_names()               # clean names

knitr::kable(head(updated_data, 3))
```

	occupation_title	x2000	x2005	x2009	x2010	x2015	x2016	x2020	x2000_2	x2005_2	x2009_2	x2010_2	x2015_2	x2016_2	x2020_2
2	Health care practitioners and technical occupations	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Audiologists	11530	10030	12590	12860	12070	12310	13300	22.92	27.72	32.14	33.58	37.22	38.11999999	42.99999997
4	Cardiovascular technologists and technicians	40080	43560	48070	48725	51405	53765	55980	16.80999999	19.98999999	23.99999999	24.38	26.97	27.45	29.3

Subset Employment Figures

These next two sections subsets the data into two data frames that focus on employment and wage figures. This allows the data to be easily pivoted separately from multiple year columns into one long-format standard.

```
updated_employment <-
  updated_data |>
  select(c(1:8)) |>
  gather('year', 'employment', -c('occupation_title')) |>
```

```
  rename(occupation = occupation_title)

updated_employment$year <-
  updated_employment$year |>
  parse_number()

knitr::kable(head(updated_employment, 3))
```

occupation	year	employment
Health care practitioners and technical occupations	2000	NA
Audiologists	2000	11530
Cardiovascular technologists and technicians	2000	40080

Subset Mean Hourly Wage Figures

```
updated_wages <-
  updated_data |>
  select(c(1, 9:15)) |>
  gather('year', 'mean_hourly_wage', -c('occupation_title')) |>
  rename(occupation = occupation_title, mean_wage = mean_hourly_wage)

updated_wages$year <-
  updated_wages$year |>
  parse_number()

knitr::kable(head(updated_wages, 3))
```

occupation	year	mean_wage
Health care practitioners and technical occupations	2000	NA
Audiologists	2000	22.92
Cardiovascular technologists and technicians	2000	16.809999999999999

Join Employment and Wage Figures

Here, the data is joined back together, where year has its own unique column and we have the figures to compare a year and occupation easier.

```
employment_wages <-
  inner_join(updated_employment, updated_wages)

knitr::kable(head(employment_wages, 3))
```

occupation	year	employment	mean_wage
Health care practitioners and technical occupations	2000	NA	NA
Audiologists	2000	11530	22.92

occupation	year	employment	mean_wage
Cardiovascular technologists and technicians	2000	40080	16.809999999999999

Occupation Names and Figures

Some of the occupation names have special characters and numbers as seen below.

```
knitr::kable(employment_wages[11:16, 1])
```

x
Magnetic resonance imaging technologists\3
Medical dosimetrists, medical records specialists, and health technologists and technicians, all other
Nuclear medicine technologists
Nurse anesthetists\4
Nurse midwives\4
Nurse practitioners\4

The *employment_wages* table is cleaned up removing unwanted characters and type casting integer and float values where appropriate

```
employment_wages <-
  employment_wages |>
  mutate(occupation = str_replace(occupation, "\\\\[:digit:]", "")) |>  # clean occupation titles
  mutate(employment = str_replace(employment, "[^[:alnum:]]+", "")) |>               # clean employment
  mutate(employment = as.integer(employment)) |>
  mutate(mean_wage = str_replace(mean_wage, "[^[:alnum:]\\.]+", "")) |>     # clean wages
  mutate(mean_wage = as.numeric(mean_wage)) |>
  drop_na(employment)   # drop rows that does not have any employment data

knitr::kable(head(employment_wages, 3))
```

occupation	year	employment	mean_wage
Audiologists	2000	11530	22.92
Cardiovascular technologists and technicians	2000	40080	16.81
Dental hygienists	2000	148460	24.99

Calculate Year-to-Year Changes between Occupations

To calculate the percent change of employment and wage figures, the *lag()* function was used, grouping by *occupation_title*.

```
employment_wages <-
  employment_wages |>
  group_by(occupation) |>
  mutate(emp_delta = employment - lag(employment),
         wage_delta = mean_wage - lag(mean_wage),
         emp_pct_chg = round(((employment - lag(employment)) / lag(employment)), 4),
```

```
        wage_pct_chg = round(((mean_wage - lag(mean_wage)) / lag(mean_wage)), 4)) |>
  arrange(occupation)

knitr::kable(head(employment_wages))
```

occupation	year	employment	mean_wage	emp_delta	wage_delta	emp_pct_chg	wage_pct_chg
Audiologists	2000	11530	22.92	NA	NA	NA	NA
Audiologists	2005	10030	27.72	-1500	4.80	-0.1301	0.2094
Audiologists	2009	12590	32.14	2560	4.42	0.2552	0.1595
Audiologists	2010	12860	33.58	270	1.44	0.0214	0.0448
Audiologists	2015	12070	37.22	-790	3.64	-0.0614	0.1084
Audiologists	2016	12310	38.12	240	0.90	0.0199	0.0242

Changes Between Employment and Mean Hourly Wage Overall

Filtering for the highest increase in percentage change in wages for each occupation regardless of year, we can see that *Nuclear medicine technologists* had the largest wage percentage change at 34.97%. Does these maximum increases within each occupation relate to how many more people are being employed from previous years?

```
top_occ <-
  employment_wages |>
    filter(!is.na(emp_delta)) |>
    group_by(occupation) |>
    filter(wage_pct_chg == max(wage_pct_chg)) |>
    arrange(desc(wage_pct_chg)) |>
    select(occupation, emp_pct_chg, wage_pct_chg)

knitr::kable(top_occ)
```

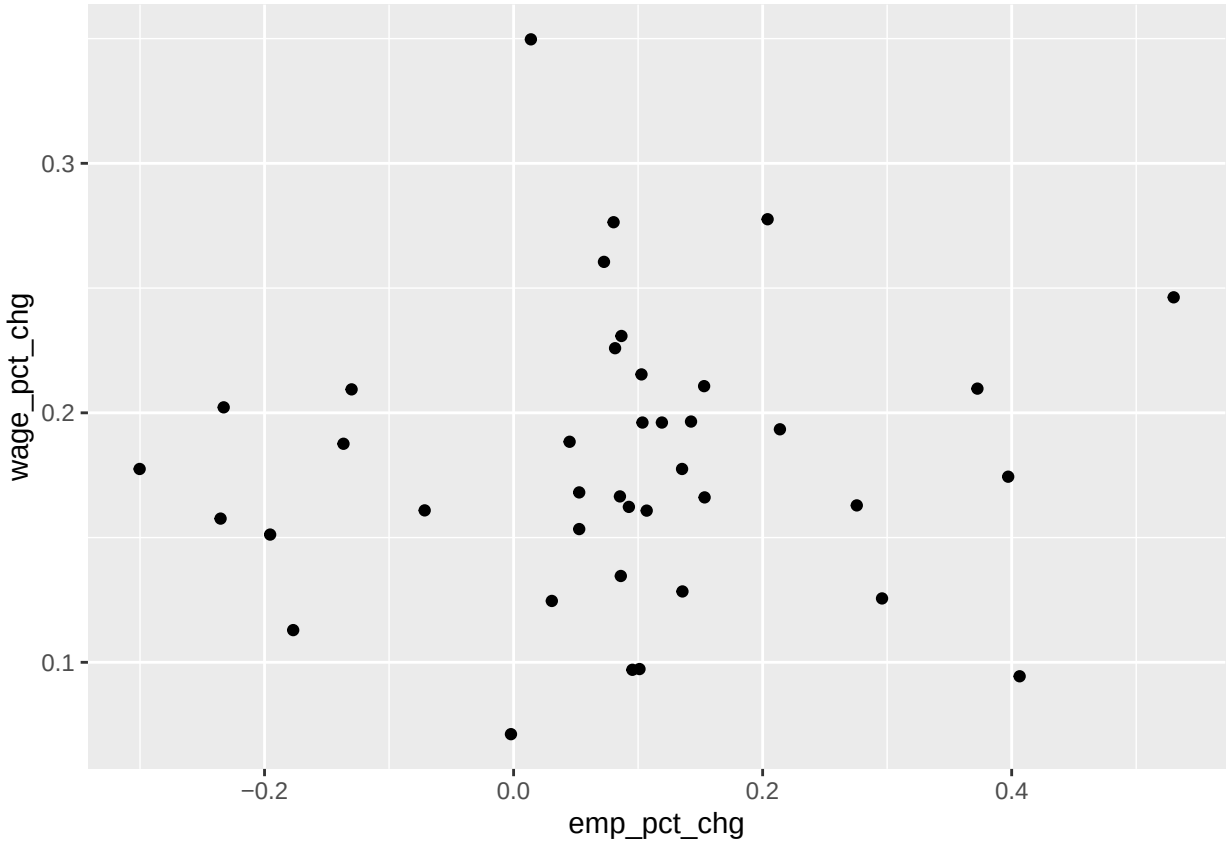
occupation	emp_pct_chg	wage_pct_chg
Nuclear medicine technologists	0.0139	0.3497
Occupational therapy assistants	0.2040	0.2776
Pharmacists	0.0803	0.2764
Radiologic technologists and technicians	0.0726	0.2605
Massage therapists	0.5301	0.2463
Physical therapist assistants	0.0866	0.2308
Registered nurses	0.0815	0.2259
Radiation therapists	0.1027	0.2154
Respiratory therapists	0.1530	0.2107
Diagnostic medical sonographers	0.3725	0.2097
Audiologists	-0.1301	0.2094
Pharmacy aides	-0.2328	0.2022
Speech-language pathologists	0.1425	0.1965
Cardiovascular technologists and technicians	0.1035	0.1961
Occupational therapists	0.1191	0.1961
Physician assistants	0.2139	0.1934
Licensed practical and licensed vocational nurses	0.0450	0.1884
Recreational therapists	-0.1366	0.1876

occupation	emp_pct_chg	wage_pct_chg
Dietitians and nutritionists	0.1353	0.1775
Occupational therapy aides	-0.3003	0.1775
Pharmacy technicians	0.3972	0.1744
Opticians, dispensing	0.0527	0.1681
Dental hygienists	0.0854	0.1665
Physical therapists	0.1534	0.1661
Medical equipment preparers	0.2756	0.1629
Nursing assistants	0.0926	0.1623
Medical transcriptionists	-0.0714	0.1609
Emergency medical technicians and paramedics	0.1069	0.1608
Psychiatric aides	-0.2353	0.1576
Nurse anesthetists	0.0527	0.1534
Psychiatric technicians	-0.1955	0.1512
Dental assistants	0.0861	0.1346
Nurse midwives	0.1356	0.1284
Medical assistants	0.2959	0.1256
Dietetic technicians	0.0307	0.1246
Orderlies	-0.1770	0.1129
Physical therapist aides	0.1011	0.0973
Magnetic resonance imaging technologists	0.0954	0.0970
Nurse practitioners	0.4064	0.0944
Clinical laboratory technologists and technicians	-0.0021	0.0712

Employee Rate Change vs. Wage Percentage Change

Plotting these changes, we can see that there is not a relationship where as employee rates increase, so does wages.

```
top_occ |>
  ggplot(aes(x = emp_pct_chg, y = wage_pct_chg)) +
  geom_point(stat = 'identity')
```


wage_pct_chg
0.3
0.2
0.1
−0.2
0.0
0.2
0.4
emp_pct_chg