

# Inequalities in the Technical Brazilian Health Workforce

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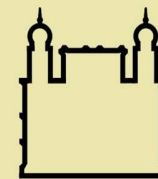
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ESCOLA POLITÉCNICA DE SAÚDE  
JOAQUIM VENÂNCIO



Ministério da Saúde

FIOCRUZ

Fundação Oswaldo Cruz

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# Who We Are

-  Brazilian Ministry of Health
  - ↳ Oswaldo Cruz Foundation
    - ↳ Polytechnic Health School Joaquim Venâncio
      - ↳ Work Laboratory and Health Care Professional Education
        - ↳ **Brazilian Health Technicians Observatory**

GOAL: Produce and share knowledge about the technical health workers, towards health workforce development in Brazil.



# The Research Project

Construction of occupational categories that represents the general Brazilian Health sector; identification of the technical workforce – analysing the qualifications, trends and characteristics of these workers.

However...

**What can we infer about technician workers in the Brazilian Health Sector?**



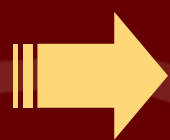
# The Research Project

- The first (and macro) approach to study these workers was done considering the **AMS** (Medical-Sanitary Assistance)
  - Survey produced by IBGE (Brazilian Institute of Geography and Statistics).
  - Investigates all the health institutions existing in the country which provide individual or collective health assistance services.



# The Research Project

- The AMS exploratory analyses brings some interesting information:
  - Health sector jobs requiring high school are concentrated in Brazil southeast region,
  - Health sector jobs requiring elementary school are concentrated in Brazil northeast region.



**A natural extension is studying the health workers, instead of establishments.**

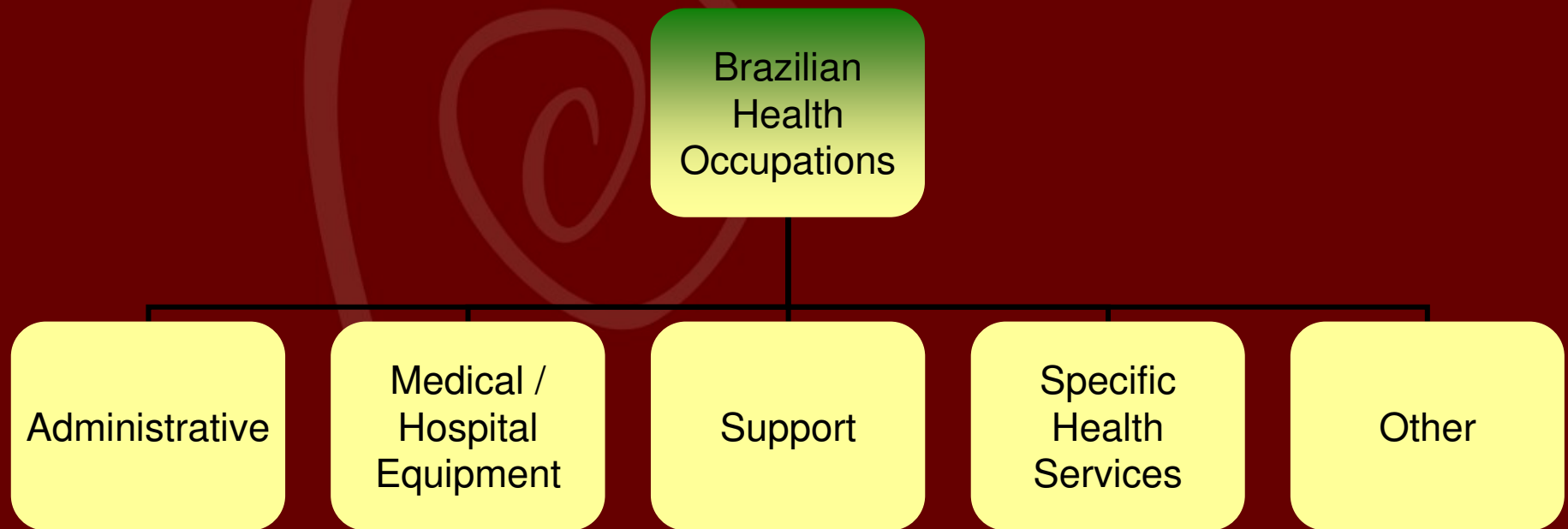
# Data Base

## PNAD: National Household Sample Survey

- Produced by IBGE (Brazilian Institute of Geography and Statistics).
- Represents a valuable instrument to the evaluation of the socio-economic and demographic reality in the country.
- Captures general attributes (self-declared) of the Brazilian population like
  - Occupation
  - Schooling
  - Labor details
  - ...

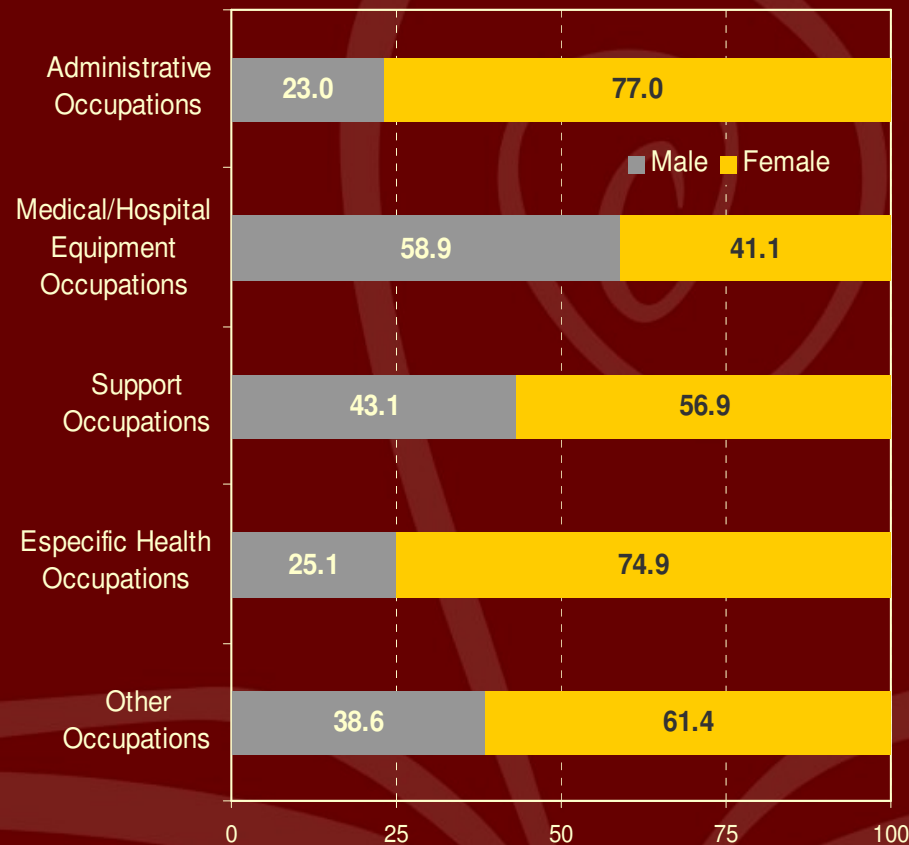


# The Health Sector

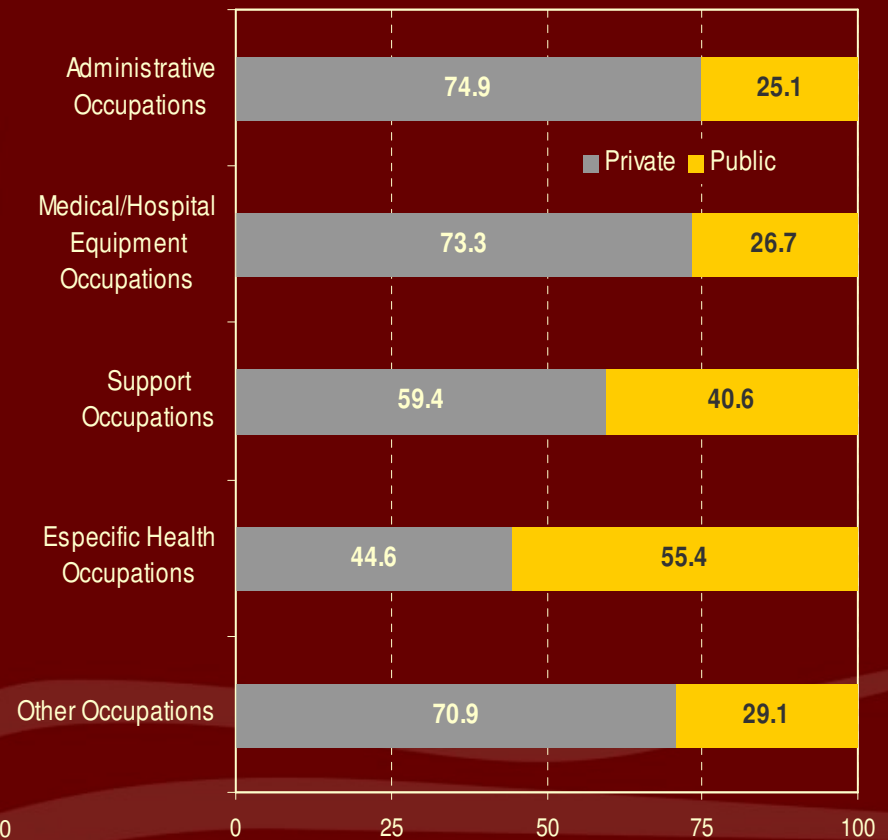


# Some Brazilian Health Workforce Idiosyncrasies

## Gender Distribution (%)

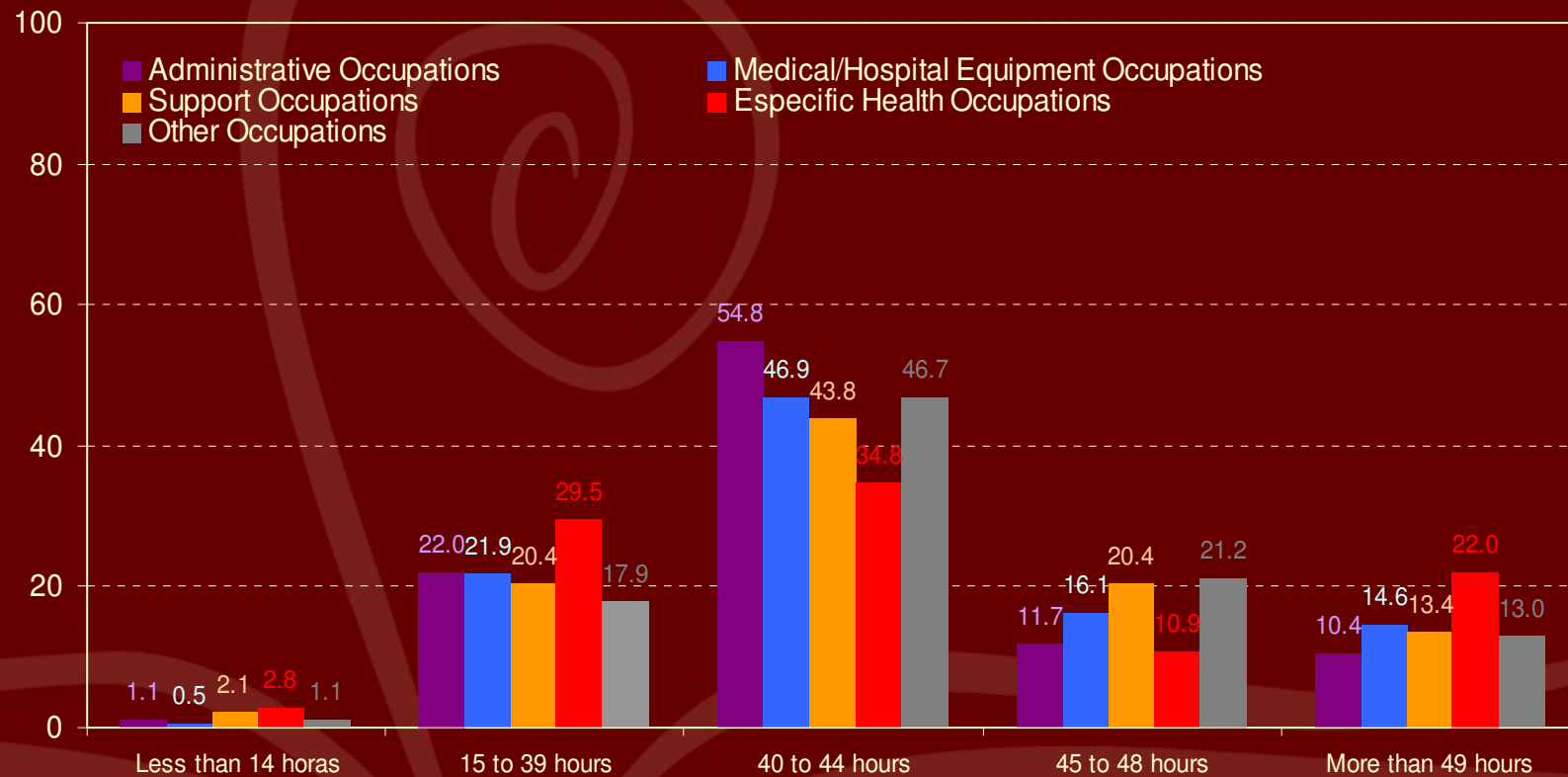


## Job Sector Distribution (%)



# Some Brazilian Health Workforce Idiosyncrasies

## Worked Hours per Week (%)



# The Problem

- The variable "occupation" was constructed based in the Brazilian Occupations Classification (CBO), a Brazilian adaptation to the International Standard Classification of Occupations (ISCO).
- Some PNAD occupations in health:
  - Nursing professionals
  - Nursing technicians
  - Chemists
  - Chemical Technicians
  - *Biologists and related (?)*



# The Objective of this Study

## Identify the technical health workers

1. Grouping occupations by similarities
2. Selecting pairs of occupations where the technicians and professionals are not fuzzy.
3. Modelling (statistically) the characteristics that *delimit* the workers as technicians and professionals.

# Statistical Help

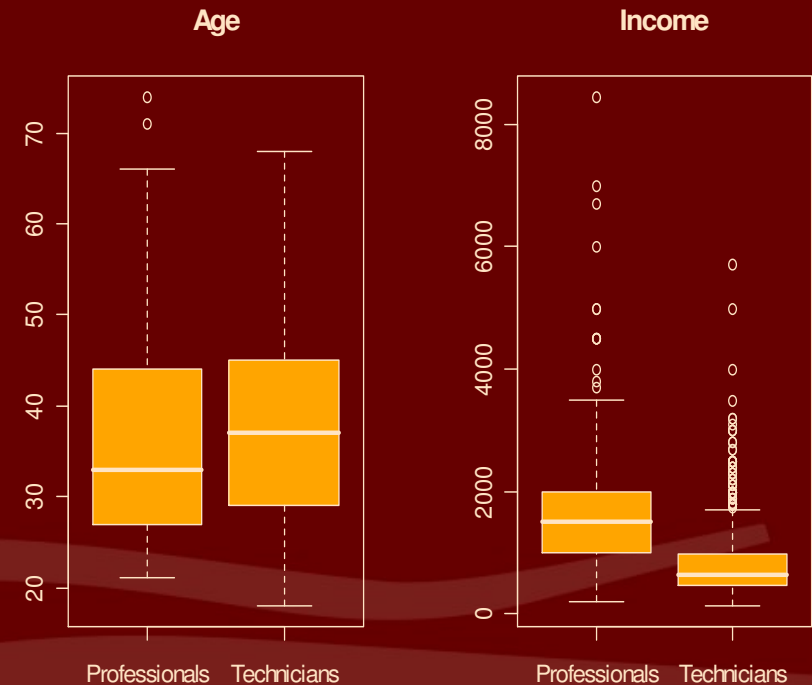
- We constructed occupation clusters for the “Specific Health Occupations” group, and selected the pairs:
  - Chemist and related technicians
  - Pharmaceutic and related technicians
  - Nursing and related technicians
  - Physiotherapy and related technicians
  - Odontologist and related technicians



# Statistical Help

## Pairs' Descriptive Statistics

		Professionals		Technicians	
<b>Gender</b>	Male	179	49.7%	181	50.3%
	Female	445	30.3%	1023	69.7%
<b>Schooling</b>	Elementary School	5	10.6%	42	89.4%
	High School	20	2.3%	832	97.7%
	Graduate	509	78.4%	140	21.6%
	Master or Doctor	28	96.6%	1	3.4%
<b>Job Sector</b>	Private	175	24.5%	540	75.5%
	Public	169	22.5%	582	77.5%
<b>Worked Hours Per Week</b>	Less than 14 hours	21	51.2%	20	48.8%
	15 to 39 hours	181	31.7%	390	68.3%
	40 to 44 hours	224	34.7%	421	65.3%
	45 to 48 hours	60	26.9%	163	73.1%
	49 hours or more	137	39.5%	210	60.5%



# Statistical Help

- In order to model/predict the relationship between workers' characteristics to their actual work position, we use the bernoulli model,
- The bernoulli probability function is expressed as:

$$P(Y = y) = \pi^y (1 - \pi)^{1-y}; \quad y = 0,1$$

where  $\pi$  is the probability of success,  $y$  corresponds to success or failure.

# Statistical Help

- The logit function was chosen by the AIC and BIC criteria.
- The variables age, gender and worked hours per week were not statistically significant, and do not belong to the final model.

<b>Coefficients</b>	<b>Estimate</b>	<b>Std. Error</b>	<b>z value</b>	<b>Pr(&gt; z )</b>
Intercept	2.0349	0.5409	3.7620	0.0002
Schooling: Elementary School	-	-	-	-
Schooling: High School	1.8733	0.5894	3.1780	0.0015
Schooling: Graduate	-2.5597	0.5550	-4.6120	0.0000
Schooling: Master or Doctor	-4.3159	1.1795	-3.6590	0.0003
Income	-0.0004	0.0001	-3.2010	0.0014
Job Sector: Private	-	-	-	-
Job Sector: Public	0.6502	0.2054	3.1660	0.0015

# Statistical Help

## Goodness-of-Fit

## Hosmer and Lemeshow Test

$$G_{HL}^2 = \sum_{i=1}^{10} \frac{(O_i - E_i)^2}{E_i(1 - E_i / n_i)} \sim \chi_8^2$$

Where:

$n_i$  is the number of observations in the  $i^{th}$  group

$O_i$  is the observed number of cases in the  $i^{th}$  group

$E_i$  is the expected number of cases in the  $i^{th}$  group

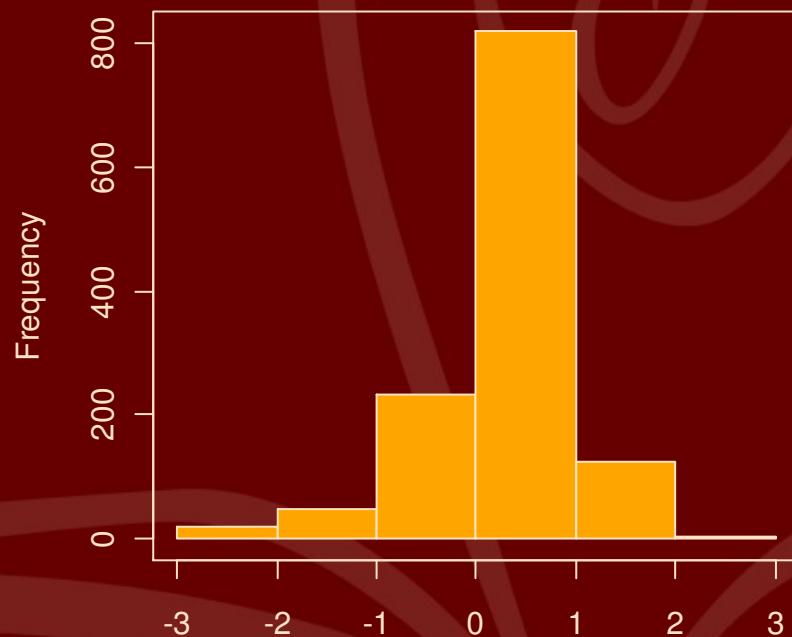
	Professionals		Technicians		Total
	Observed	Expected	Observed	Expected	
1	102	104.25	27	24.75	129
2	97	88.46	30	38.54	127
3	71	74.71	53	49.29	124
4	17	21.46	107	102.54	124
5	3	3.07	114	113.93	117
6	3	3.04	122	121.96	125
7	2	2.82	123	122.18	125
8	5	2.12	129	131.88	134
9	1	1.65	124	123.35	125
10	2	1.41	117	117.59	119

P-value: 31.78%

# Statistical Help

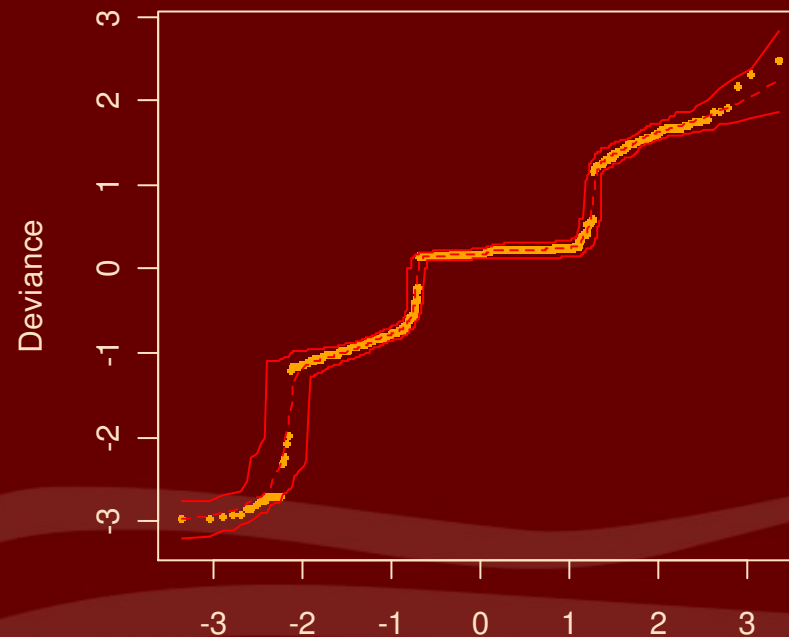
## Residual Analysis

Studentized Residuals



Studentized Residuals

Normal Q-Q Plot



Standard Normal Quantile

# Statistical Help

- In order to evaluate the predictive power, we calculate the confusion matrix, and:
  - **Total rate of "correct" classification: 88.3%**
  - Percentage of professionals well classified: 93.1%
  - Proportion of technicians well classified: 86.8%.



# Reading the Model

## Schooling

- Workers with high school as higher level have 6 times more chances to be technicians than those who have just elementary school
- University graduates have 13 times more chances to be a professional
- Master/doctoral graduates are 75 times more likely to be professionals than those with elementary school.

## Job Sector

- Workers in public institutions have approximately 2 times more chances to occupy a technical position.

# Results and Conclusions

- Imbalances:
  - 14% of health workers in technicians occupations are university graduates: bachelors or masters/doctorate;
  - 66% of the workers in technicians occupations work more than 40 hours per week.
- Study Benefits:
  - A right work insertion based on schooling has a larger impact in the public health sector.
  - The multiple work links diminishes the income impact (estimated coefficient: -0.0004);
  - **The model allowed us to *identify* the large numbers of technicians with university degree, masters/doctorate**
  - **Estimating the Brazilian health technical workforce stock.**

# Further Work

- Extend the cluster analysis to the other four identified health occupations groups (managers, medical/hospital equipment, support and others),
- Sophisticate the model to cover all health occupations groups.
- Explore data availability from all years of the survey, towards understanding trends in the qualification and work insertion of this workforce.



# Thanks!!!

**Polytechnic Health School  
Joaquim Venâncio:**

**[www.epsjv.fiocruz.br](http://www.epsjv.fiocruz.br)**

**International Network of Health  
Technicians Education:**

**[www.rets.epsjv.fiocruz.br](http://www.rets.epsjv.fiocruz.br)**

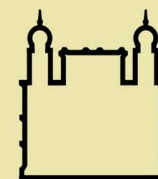


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