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# Analytical Plan for Association between leadership commitment and professional development at NASA (2020): unweighted sex-adjusted stratified analysis

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## Document version

Version	Alterations
01	Initial version

## 1 ABBREVIATIONS

- CI: confidence interval
- FEVS: Federal Employee Viewpoint Survey
- OPM: U.S. Office of Personnel Management
- OR: odds ratio

## 2 CONTEXT

The Federal Employee Viewpoint Survey (FEVS) addressed leadership commitment, professional development, and telework satisfaction while accounting for gender (OPM, 2020). This analysis addresses a subset of the FEVS survey reflecting NASA employees.

### 2.1 Objectives

Quantify the association between leadership commitment and employee professional development at NASA from the 2020 Federal Employee Viewpoint Survey, disregarding the FEVS survey weights.

### 2.2 Hypotheses

There is a statistically significant correlation between leadership commitment, and professional development among NASAs employees in a telework environment after accounting for gender (men and women).

### 2.3 Study design

Case-control to assess prevalence from a complex-designed survey, where sampling weights were not used to account for sampling uncertainty.

## 3 DATA

### 3.1 Raw data

Raw data was collected as a census of the eligible population (OPM, 2020), and statistical weighting was applied at the data collection to adjust for non-responses in the census attempt. These survey weights allow for the estimation of the association under study in the source population, but this analysis will not adjust the estimates with the survey design effects (see Observations). The raw data was filtered to reflect only NASA survey respondents (where agency code equals NN).

The original data base had 8 variables collected on 10588 observations.

Survey questions measured responses in a 5-point Likert scale between 1 (strongly disagree) and 5 (strongly agree). Some questions offered the option to choose "X" (Don't know) as the answer. These unknown answers were considered non-answers and treated as missing values (see section 5.1.4).

### 3.2 Analytical dataset

This analysis will focus on two questions from the FEVS survey, where the main interest is employee satisfaction (q1 – I am given a real opportunity to improve my skills in my organization) as the dependent variable and leadership commitment (q21 – Supervisors in my work unit support employee development) as the independent variable. As per the data cleaning process, the dependent variable was renamed to *dv* and the independent variable was renamed to *iv* in the analytical dataset. Additionally, in order to calculate the OR the survey responses were categorized as binary responses, where agreement was aggregated from the "agree" and "strongly agree" responses, in variables *dv2* and *iv2*.

The study includes respondents that have answered the survey in agreement (4 or 5) or disagreement (1 or 2) to any of the questions. The participants that answered 3 (Neither agree nor disagree) will be excluded.

After the cleaning process 6 variables were included in the analysis. The total number of surveys excluded due to incompleteness and exclusion criteria will be reported in the analysis. Table 1 shows the structure of the analytical dataset. All variables in the analytical set were labeled according to the raw data provided and values were labeled according to the data dictionary for the preparation of production-quality results tables and figures.

**Table 1** Analytical dataset structure after variable selection and cleaning.

id	dsex	dv	iv	dv2	iv2
1					
2					
3					
...					
N					

## 4 STUDY VARIABLES

For this case-control study the exposures were defined as whether or not the survey respondent perceived high levels of leadership commitment, expressed by the agreement with the question. Surveys that did not perceive high levels of commitment (answer 1-2) were classified in the unexposed group and surveys.

The cases and controls are defined in the primary outcome, described below.

### 4.1 Primary and secondary outcomes

**Specification of outcome measures** (Zarin, 2011):

1. (Domain) Employee satisfaction
2. (Specific measurement) Survey question
3. (Specific metric) End value
4. (Method of aggregation) Odds of participants that agree or strongly agree with survey question

#### Primary outcome

Odds of participants that perceive opportunities of employee professional development at NASA from the 2020 Federal Employee Viewpoint Survey.

### 4.2 Covariates

The association between exposures and the outcome will be stratified by the sex of survey respondents.

## 5 STATISTICAL METHODS

### 5.1 Statistical analyses

#### 5.1.1 Descriptive analyses

Survey characteristics will be described as counts and proportions (%). The distributions of participants' characteristics will be summarized in tables and visualized in exploratory plots.

#### 5.1.2 Inferential analyses

Differences in distribution of categorical variables will be assessed with the chi-square test without Yates correction. The OR will be used as a measure of effect of the independent variable on the dependent variable.

The stratification by sex will be used to assess if the effect changes across male and female strata. As a rule of thumb, a minimum change of 20% in the OR will be considered before concluding that there is an interaction between sex and the independent variable. The homogeneity of the OR across strata will be assessed with the Cochran-Mantel-Haenszel test.

#### 5.1.3 Statistical modeling

N/A

#### 5.1.4 Missing data

No missing data imputation will be performed. All evaluations will be performed as complete case analyses.

### 5.2 Significance and Confidence Intervals

All analyses will be performed using the significance level of 5%. All significance hypothesis tests and confidence intervals computed will be two-tailed.

### 5.3 Study size and Power

N/A

### 5.4 Statistical packages

This analysis will be performed using statistical software R version 4.1.2.

## 6 OBSERVATIONS AND LIMITATIONS

### Survey weights

Sometimes some sub-populations of the target population can be hard to find or are scarce. Complex survey designs allow for the study estimations be performed with over-sampling of these sub-populations. The FEVS survey used a statistical weighting to adjustment for the design effects of the survey and by involving them the previous analysis effectively simulated a census of the NASA employees perception of the workplace culture (see associated analysis **SAR-2022-007-GJ-v02**). Its large sample provided high levels of statistical power to detect even small differences in proportions. This is one reason that most p-values could be reasonably expected to be significant in that analysis.

This unweighted analysis does not consider the survey weights, and as such, does not take into account the complex design of the FEVS survey. Although this choice allows for simpler methods to be used it may also lead to bias in the estimated odds ratios.

Note that the previous analysis also used a different inclusion criteria where all survey responses were used. The results from this analysis might not be directly comparable to that one given this difference in methodological choices.

## 7 REFERENCES

- **SAR-2022-011-GJ-v01** – Association between leadership commitment and professional development at NASA (2020): unweighted sex-adjusted stratified analysis
- **SAR-2022-008-GJ-v02** – Association between leadership commitment and professional development at NASA (2020): weighted sex-adjusted stratified analysis
- OPM (2020). 2020 Federal Employee Viewpoint Survey – Technical report (<https://www.opm.gov/fevs/reports/technical-reports/>).
- Zarin DA, et al. The ClinicalTrials.gov results database – update and key issues. N Engl J Med 2011;364:852-60 (<https://doi.org/10.1056/NEJMsa1012065>).
- Gamble C, et al. Guidelines for the Content of Statistical Analysis Plans in Clinical Trials. JAMA. 2017;318(23):2337–2343 (<https://doi.org/10.1001/jama.2017.18556>).

## 8 APPENDIX

This document was elaborated following recommendations on the structure for Statistical Analysis Plans (Gamble, 2017) for better transparency and clarity.

## 8.1 Associated analyses

This analysis is part of a larger project and is supported by other analyses, linked below.

### **Association between leadership commitment and professional development at NASA (2020): weighted sex-adjusted stratified analysis**

<https://philsf-biostat.github.io/SAR-2022-008-GJ/>

### **Association between leadership commitment and telework satisfaction at NASA (2020): weighted sex-adjusted stratified analysis**

<https://philsf-biostat.github.io/SAR-2022-007-GJ/>

### **Association between leadership commitment and telework satisfaction at NASA (2020): unweighted sex-adjusted stratified analysis**

<https://philsf-biostat.github.io/SAR-2022-010-GJ/>

## 8.2 Availability

Both this analytical plan and the corresponding analysis report (**SAR-2022-011-GJ-v01**) can be downloaded in the following address:

<https://philsf-biostat.github.io/SAR-2022-011-GJ/>