Association between leadership commitment and professional development at NASA (2020): 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.

2.2 Data reception and cleaning

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 in the census attempt. These survey weights (variable `postwt`) allow for the estimation of the association under study in the source population. The raw data was filtered to reflect only NASA survey respondents (where agency code equals `NN`).

The raw data is expected to reflect a total employee population at NASA at 16809 employees but after cleaning procedures the observations in the analytical data represents a total of 15283 NASA employees. 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.

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. 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, to calculate the OR the responses were categorized as binary responses, where agreement was aggregated from the “agree” and “strongly agree” responses, in variables `dv2` and `iv2`. After the cleaning process 7 variables were included in the analysis with 9633 observations.

3 METHODS

3.1 Variables

3.1.1 Primary and secondary outcomes

Primary outcome

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

3.1.2 Covariates

The association will be stratified by the sex of survey respondents.

3.2 Statistical analyses

The epidemiological profile of the study participants will be described. Demographic (sex, age and BMI) will be described as mean (SD) or as counts and proportions (%), as appropriate. All comparisons between groups will be performed as univariate analyses. Differences in distribution of categorical variables will be assessed with the chi-square test with the adjustment of design effect for weighted survey data. 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. All evaluations will be performed as complete case analyses. All analyses will be performed using the significance level of 5%. This analysis was performed using statistical software R version 4.1.2.

4 RESULTS

4.1 Study population and follow up

The sample evaluated in this study is comprised of 9633 observations representing 15283 NASA employees, out of a total of 16809. Two thirds of the study population are males (66.4%, Table 1).

Both survey questions addressed in this study showed most NASA employees demonstrated high levels of satisfaction when the survey was conducted. The proportion of employees that agree or strongly agree with the main outcome of this study (q1 – I am given a real opportunity to improve my skills in my organization) was 88.5%. The proportion of employees that agree or strongly agree with leadership commitment (q21 – Supervisors in my work unit support employee development) was 93.1%.

Table 1 *Characteristics of the study population. Each of the survey questions had 5 alternatives for answer: 1: strongly disagree, 2: disagree, 3: neither agree nor disagree, 4: agree, 5: strongly agree.*

Characteristic	N = 15,283
Sex	
Male	10,154 (66)
Female	5,129 (34)
I am given a real opportunity to improve my skills in my organization.	
1	183 (1.2)
2	477 (3.1)
3	1,104 (7.2)
4	6,137 (40)
5	7,382 (48)
Supervisors in my work unit support employee development.	
1	152 (1.0)
2	232 (1.5)
3	678 (4.4)
4	4,640 (30)
5	9,581 (63)

4.2 Association between leadership commitment and professional development

4.2.1 Overall association

Table 2 *caption*

Characteristic	Overall, N = 15,283[1]	I am given a real opportunity to improve my skills in my organization,n (%)					p-value[2]
		1, N = 183[1]	**2**, N = 477[1]	**3**, N = 1,104[1]	**4**, N = 6,137[1]	**5**, N = 7,382[1]	
Supervisors in my work unit support employee development,n (%)							<0.001
1	152 (1.0)	81 (44)	45 (9.4)	10 (0.9)	11 (0.2)	5 (<0.1)	
2	232 (1.5)	39 (21)	97 (20)	46 (4.2)	42 (0.7)	8 (0.1)	
3	678 (4.4)	21 (11)	119 (25)	264 (24)	238 (3.9)	37 (0.5)	
4	4,640 (30)	15 (8.1)	161 (34)	534 (48)	3,127 (51)	803 (11)	
5	9,581 (63)	27 (15)	56 (12)	250 (23)	2,719 (44)	6,529 (88)	

[1]n (%) [2]chi-squared test adjusted by a design effect estimate

4.2.2 Stratification by sex

Table 3 *caption*

Characteristic	I am given a real opportunity to improve my skills in my organization								
	Overall			Males			Females		
	No Agree, N = 1,764[1]	**Agree**, N = 13,519[1]	**p-value**[2]	**No Agree**, N = 1,180[1]	**Agree**, N = 8,974[1]	**p-value**[2]	**No Agree**, N = 584[1]	**Agree**, N = 4,545[1]	**p-value**[2]
Supervisors in my work unit support employee development.			<0.001			<0.001			<0.001
No Agree	722 (41%)	340 (2.5%)		461 (39%)	206 (2.3%)		260 (45%)	134 (3.0%)	
Agree	1,043 (59%)	13,179 (97%)		719 (61%)	8,768 (98%)		324 (55%)	4,411 (97%)	

[1]n (%) [2]chi-squared test adjusted by a design effect estimate

The overall association appears to have an interaction with sex.

- CMH: p<0.001

CMH test confirms an interaction is detectable.

- OR overall: OR: 26.81, 95% CI: [23.25, 30.96]
- OR males: OR: 27.26, 95% CI: [22.78, 32.70]
- OR females: OR: 26.36, 95% CI: [20.84, 33.51]

Interpretation:

1. Leadership commitment is associated with an increase of 2581% in professional development.
2. There **is** effect modification by sex in the association
   - males appear to perceive more professional development than females when leadership shows high commitment.
   - effect of association between commit and development is **huge** (OR ~ 27!!), and relative difference between effects is not as large (may not be a true interaction)

Obs: high precision due to large study power.

4.2.2.1 Additional analyses

- sex and iv: p=0.402
- sex and dv: p=0.195

Sex is not associated with either leadership commitment or employee satisfaction.

5 OBSERVATIONS AND LIMITATIONS

6 CONCLUSIONS

7 REFERENCES

- **SAP-2022-008-GJ-v02** – Analytical Plan for Association between leadership commitment and professional development at NASA (2020): sex-adjusted stratified analysis

8 APPENDIX

8.1 Exploratory data analysis

8.2 Availability

Both this document and the corresponding analytical plan (**SAP-2022-008-GJ-v01**) can be downloaded in the following address:

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

8.3 Analytical dataset

Due to confidentiality the data-set used in this analysis cannot be shared online in the public version of this report.

Table A1 *Analytical dataset structure*

id	dsex	dv	iv	dv2	iv2	postwt
1						
2						
3						
…						

9633						