Seattle Office of Inspector General

Analysis of Gender Disparities in Wages and Career Outcomes Within the Seattle Police Department

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Introduction

Objective and Scope

This report reviews a quantitative analysis commissioned by the Seattle Police Department (SPD) to assess progress toward and barriers to recruiting women into its sworn ranks as part of the 30x30 Initiative. The Office of Inspector General (OIG) observed discrepancies between this quantitative analysis and an earlier qualitative study commissioned by SPD and completed by the same researcher. OIG also conducted its own analysis which analyzed data to compare rates of wage growth, overtime hours, complaints received, and career duration between men and women. OIG found that men:

- Had faster wage growth than women,
- Worked more overtime hours,
- Received more complaints from civilians, and
- Had a median career duration five years greater than that of women.

Background

SPD is participating in the 30x30 Initiative, a nationwide effort to increase the representation of women police recruits to 30 percent by the year 2030.[1] Gender diversity in police departments provides benefits including:

- Increased civilian trust in policing,[2]
- Decreased use of force,[3] and
- Fewer civilian complaints against officers.[4]

Women comprise half of the U.S. population but only 14 percent of the nation's sworn officers, according to the 2024 FBI Uniform Crime Reporting Statistics.[5] This disparity is wider in the upper ranks of departments, with women comprising three percent of police chiefs and approximately seven percent of other command positions.[6] Leadership inequities in U.S. police departments have been attributed to:

- A hypermasculine culture that discourages women from pursuing law enforcement careers,[7]

1 About 30x30: Advancing and Supporting Women in Policing.

2 Barnes, T.D., Beaulieu, E., and Saxton, G.W. (2018). Restoring trust in the police: Why female officers reduce suspicions of corruption. *Governance, 31*(1), 143–161.

3 Rabe-Hemp, C.E. (2008). Female officers and the ethic of care: Does officer gender impact police behaviors? *Journal of Criminal Justice, 36*(5), 426–434.

4 Schuck, A.M., and Rabe-Hemp, C. (2016). Citizen complaints and gender diversity in police organisations. *Policing and Society, 26*(8), 859–874.

5 Federal Bureau of Investigation, Uniform Crime Report. (2023). Law Enforcement Employees Reported by the United States. (Accessed 24 November 2024).

6 Todak, N. (2023). "A Panel of Good Ol' Boys": Women navigating the police promotions process. *American Journal of Criminal Justice, 48*(4), 967–983.

7 Todak (2023).

- Unrealistic performance expectations and low job satisfaction that leads to attrition,[8,9]
- Frequent sexual harassment and exposure to vulgar language that increases as they ascend ranks,[10]
- Men's preference to promote other men instead of equally or better-qualified women,[11] and
- Promotion processes that disadvantage officers with responsibilities outside of work, most of whom are women.[12]

To measure its progress toward meeting 30x30 Initiative goals, SPD commissioned qualitative[13] and quantitative[14] assessments comparing workplace experiences and career outcomes of sworn men and women. According to the qualitative assessment, women experienced severe and recurring sexual harassment, exclusion from social and professional development opportunities, and obstacles to pursuing and remaining in leadership positions. By contrast, the quantitative assessment did not find evidence of any disparity between men and women in sustained complaints, number of promotions, or highest rank achieved during employment. Although the assessment identified that women made $36,000 less than men over the course of their careers, it did not identify any reasons for this difference. The SPD quantitative assessment also did not examine why the results may have differed from those of the qualitative assessment.

The difference in conclusions prompted OIG to review the quantitative analysis (Appendix A) to assess whether discrepancies between the two reports were attributable to methodological decisions. In addition to this review, OIG performed an independent quantitative analysis of gender disparities in complaints received, salary growth, and overtime. OIG's conclusions aligned with the SPD qualitative analysis and the statements made by women at SPD. Technical documentation of OIG's methods can be found in Appendix B.

The OIG analysis expands upon the SPD analysis in four important ways:

1. SPD measured gender disparities in total wages earned over the course of an officer's career. OIG compares annual wage growth for men and women throughout their employment at SPD, including and excluding overtime hours.
2. In contrast to the SPD analysis, the OIG analysis considered all complaints regardless of whether they were sustained by the Office of Police Accountability (OPA). OIG expanded the definition of complaints for two reasons. First, because complaints stem from perceived injustice, considering all complaints, regardless of outcome, better represents community members' perceptions of SPD.[15] Second, considering only sustained complaints risks emphasizing OPA's investigative procedures over perceptions of officers' activities.

8 Yu, H.H. (2024). Women in law enforcement: The glass cliff and gender revisited. *Public Personnel Management, 53*(4), 511–521.

9 Padilla, K.E, Renfro, K., & Huff, J. (2024). "The bar is different as a woman": A thematic analysis of career advice given by female police officers. *Policing: A Journal of Policy and Practice, 18*.

10 Padilla et al. (2024).

11 Franklin, C.A. (2005). Male peer support and the police culture: Understanding the resistance and opposition of women in policing. *Women and Criminal Justice, 16*(3), 1–25.

12 Todak (2023).

13 James, L. (2023, September 26). Seattle Police Department 30x30 report.

14 James, L. (2024, November 8). Seattle Police Department gender disparity in promotions report.

15 Terrill, W., & Paoline III, E. A. (2015). Citizen complaints as threats to police legitimacy: The role of officers' occupational attitudes. *Journal of Contemporary Criminal Justice, 31*(2), 192–211.

3. OIG compares men and women's overtime hours, which SPD implicated as a reason for gendered wage disparities but did not directly assess.
4. OIG compares median career duration for men and women. Differing career durations could explain differences in total wages earned over the course of employment.

Gender Versus Sex

SPD did not provide a formal definition of gender in its quantitative analysis. The analysis simply compared career outcomes between men and women. For the purposes of this report, OIG defines gender as an officer's identification as male or female, based on SPD human resources information systems (HRIS) records. Information stored in the SPD HRIS must comply with a federal government requirement to report gender data using the male-female binary. OIG acknowledges this definition conflicts with both expert opinion and individual lived experiences. While this definition does not reflect OIG's views on gender and sexuality, it is used in the OIG analyses (Appendix B) solely to maintain consistency with SPD's analyses.

Sex and gender are distinct.[16] Sex is assigned at birth based on physical characteristics, namely chromosomes and genitalia. Gender is more complex, encompassing the social roles and expectations associated with gender assignment. Gender also includes how individuals understand and behave in relation to those roles and expectations. OIG uses the term "gender disparities" instead of "sex disparities," because bias and discrimination are related to social factors, not biological ones. In the summary of the OIG analyses, OIG uses the terms woman and man instead of female and male.

OIG Analysis

OIG identified the following disparities in sworn career outcomes:[17]

- Men and women's standard hourly wages increased by $2.14 and $1.82 for each year of employment, respectively.[18] Figure 1 estimates trajectories of wage growth for officers who remain at SPD for 30 years after January 1, 2013, or their start date, whichever occurred later. Men and women's starting hourly wages were $41.14 and $40.40, respectively; this difference was not statistically significant.
- Men received 19 percent more complaints from civilians than women.
- Men and women worked 243 and 151 overtime hours per year, respectively.

16 Kaufman, M.R., Eschliman, E.L., Karver, T.S. Differentiating sex and gender in health research to achieve gender equity. (2023). *Bulletin of the World Health Organization, 101*(10), 666–671.

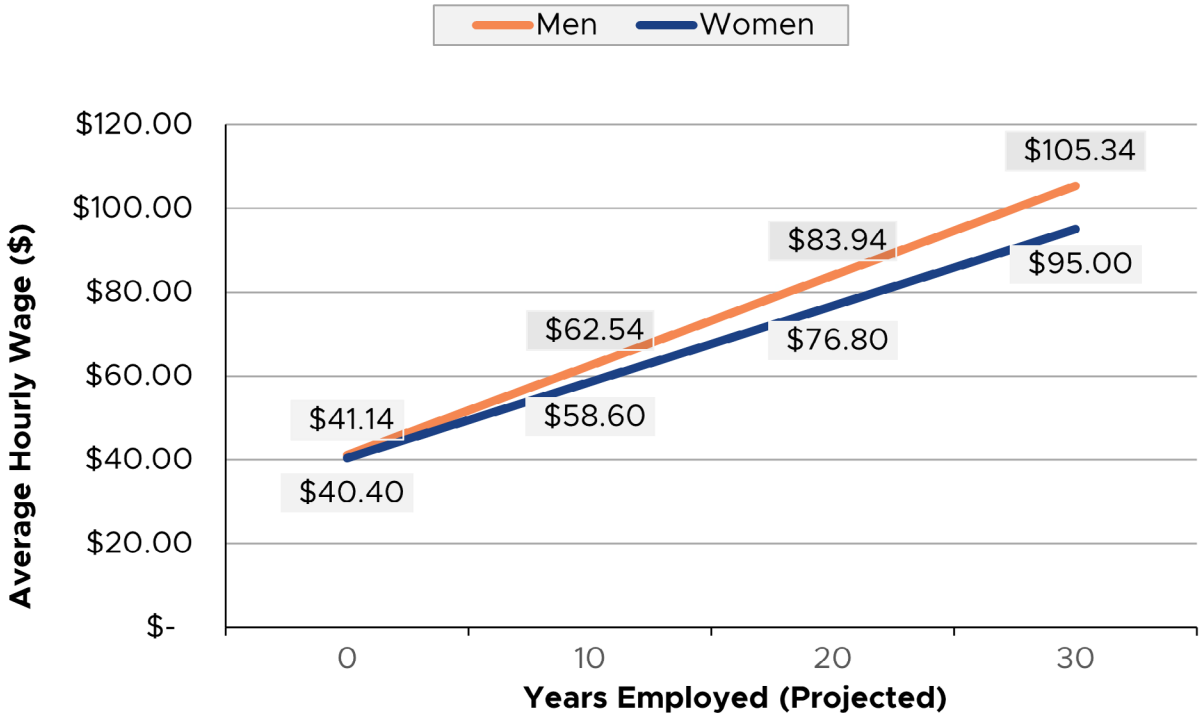
17 OIG did not assess disparities in highest rank achieved and number of promotions. Results of the Spearman's rank order correlation test between SPD's ranking of positions (Table 2) and their associated hourly pay rates revealed a strong correlation, $\rho(8) = 0.98$, $p < .001$. Thus, wages serve as a proxy measure for rank and promotions.

18 Standard hourly wage is defined as any hourly compensation to an officer that matches or approximately matches (±$1) the regular rate associated with their rank in the collective bargaining agreement's salary schedule. The calculation for standard hourly wage considers paid time off, sick leave, shift differentials, and out of class assignments and excludes all overtime premiums.

- Men worked more overtime hours as they progressed throughout their careers, but women did not.
- Men and women, on average, worked at SPD for 30.0 and 25.5 years, respectively.

OIG found that hourly wage growth lagged for women. This result comports with the SPD finding that men made approximately $36,000 more than women over the course of their careers. SPD attributed this discrepancy to a "kid tax," with women working fewer overtime hours than men due to caregiving obligations. Although OIG found gender disparities in overtime hours, OIG also found disparate annual growth rates in regular hourly wages between men and women. Together, these findings suggest that caregiving obligations cannot fully explain disparities in compensation. Because collective bargaining agreements equalize salaries for officers of the same rank, a likely explanation is that women at SPD are promoted at a slower tempo than men.[19]

Figure 1. Estimated Average Hourly Wages for Men and Women by Years of Employment



OIG also found that men received 19 percent more complaints from civilians than women. This analysis adjusted for assignment to units most likely to receive complaints, such as Special Weapons and Tactics (SWAT) and the Community Response Group (CRG), which contain disproportionately high numbers of men.[20] Thus, unit assignment was removed as a basis to explain the association between gender and complaints. Although OIG did not explore reasons for disparities in complaints, prior research

19 Agreement by and between the City of Seattle and the Seattle Police Officers Guild.

20 More than 90 percent of officers in the SWAT and CRG units are men, per SPD's HRIS records.

indicates men arrest and use reportable levels of force against civilians more frequently than women.[21,22] This finding contrasts with that of the SPD analysis, which found no association between gender and complaints. OIG attributes this difference to the scope of complaints examined in each analysis: whereas SPD considered only complaints sustained by OPA, OIG considered all complaints received. For this reason, findings from the OIG and SPD analyses of complaints are not comparable.

OIG found that women had shorter employment tenure with SPD. The median duration of employment for men and women was 30.0 and 25.5 years, respectively.[23] OIG did not have access to reasons for employee departures to explore this disparity. However, results from the SPD qualitative analysis revealed most participants "would not encourage other women in their lives to join the department" (p. 13), implying that career dissatisfaction may be motivating women to seek employment elsewhere.[24]

Conclusion

OIG sought to understand the discrepancies between the SPD qualitative and quantitative reviews of progress toward the 30x30 Initiative goals. OIG's independent quantitative review included findings that are broadly consistent with those from the SPD qualitative assessment, insofar as women described obstacles to promotion that men did not encounter. Given that wages are a proxy for rank, and wage growth was slower for women than men, findings in this report affirm these statements. The OIG analysis also identified that men took more overtime opportunities and had a median career duration five years greater than women. OIG also found that men received 19 percent more complaints, suggesting that gender diversification may improve community perceptions of SPD.[25] Overall, the OIG analysis resulted in findings that not only aligned with the experiences reported by women at SPD, but also with national trends and research. The OIG analysis also went further by providing reasons for the $36,000 career pay difference between men and women that SPD identified.

Future research should use qualitative methods to examine why men receive more complaints than women from civilians but not from other officers, given that women interviewed for the SPD qualitative analysis identified recurrent sexist and other inappropriate behaviors from men occurring in the workplace.[26] Future research should also examine barriers to reporting harassment that inhibit filing complaints against fellow officers, like fear of retaliation or disbelief that a complaint will produce meaningful change.[27,28] Qualitative research should also explore why tenure with SPD is approximately five years shorter for women.

21 Rabe-Hemp (2008).

22 Brandl, S.G., & Stroshine, M.S. (2013). The role of officer attributes, job characteristics, and arrest activity in explaining police use of force. *Criminal Justice Policy Review, 24*(5), 551–572.

23 Fifty percent of men were employed by SPD for less than 30 years, and 50 percent of women were employed by SPD for less than 25.5 years. This statistic suggests that women are likely to depart SPD earlier in their careers than men.

24 James (2023).

25 Terrill & Paoline (2015).

26 James (2023).

27 Paoline, E.A. (2003). Taking stock: Toward a richer understanding of police culture. *Journal of Criminal Justice*, *31*(3), 199–214.

28 Lee, D., & Yu, H.H. (2020). Breaking the code of silence: Who are the women reporting sex-based discrimination in federal regulatory agencies? *Policing: An International Journal, 43*(4), 575–589.

Appendix A: Seattle Police Department's Analysis

Key Findings

SPD analyzed HRIS data of 2,015 sworn officers between January 1, 2015, and June 18, 2024, to identify gender disparities in the following outcomes:[29]

- **Complaints**: All complaints, sustained or not sustained
- **Highest Rank**: The highest rank achieved
- **Number of Promotions**: The count of promotions
- **Dollars Earned**: Sum of earnings prior to June 18, 2024

SPD found that over the course of their careers, women earned $36,000 less than men. SPD did not identify gender disparities in complaints, highest rank, or number of promotions.

Methodology

SPD arrived at these conclusions by building a series of models that approximated whether gender caused disparities in each outcome.

Traditionally, identifying whether a phenomenon causes an outcome has required researchers to develop a randomized controlled trial (RCT), which entails:

1. Developing a hypothesis that forecasts a cause and effect
2. Selecting a group of individuals from the population of interest at random
3. Assigning each selected individual to a group exposed and unexposed to the causative variable
4. Comparing the outcome of interest among the groups

Although considered a gold standard of research, conducting an RCT is often impossible, impractical, or unethical. In such circumstances, analysts might use observational studies instead. Observational studies group individuals who volunteer to share data based on a preexisting behavior of interest. However, because these groups are not formed at random, individuals within them may differ in other regards that could also explain discrepancies in outcomes. These other differences, known as confounds, constrain an experimenter's ability to identify a cause-and-effect relationship.

Causal inference is a branch of statistics dedicated to simulating experimental conditions when they cannot be achieved in real-world settings. One causal inference method, propensity score weighting, calculates the probability that an individual will experience "treatment," or the outcome of interest, based on a set of potential confounds.[30] This probability is known as the propensity score. When estimating disparities, individuals whose treatment status is unlikely according to their propensity scores are weighted more heavily because they are less likely to be confounded (Table 1).

29 For officers who entered or left the department within the analysis period, all available data were used.

30 Freedman, D.A., & Berk, R.A. (2008). Weighting regressions by propensity scores. *Evaluation Review, 32*(4), 392–409.

Table 1. Demonstration of Propensity Score Weighting Procedure

	Low Propensity Score	High Propensity Score
Untreated	• Propensity score indicates a low probability of treatment, and treatment is not present • Weighed less heavily because more likely to be confounded	• Propensity score indicates a high probability of treatment, but treatment is not present • Weighed more heavily because less likely to be confounded
Treated	• Propensity score indicates a low probability of treatment, but treatment is present • Weighed more heavily because less likely to be confounded	• Propensity score indicates a high probability of treatment, and treatment is present • Weighed less heavily because more likely to be confounded

Note. The propensity score is a numeric representation between 0 and 1 of the probability of treatment status.

The potentially confounding variables used to calculate a propensity score are known as covariates. In SPD's analysis, these covariates included:

- **CAD Count**: Count of officer's dispatches through the computer-assisted dispatch (CAD) system
- **Certification Count**: Count of officer's certifications
- **I/O Report Count**: Count of incident/offense (I/O) reports written by officer
- **Last Year Worked**: Year officer received last paycheck from SPD
- **Maximum Compensation Rate**: Maximum hourly wage provided to officers
- **Military Experience**: Whether officer is a U.S. veteran (0 = "No"; 1 = "Yes")
- **Officer Age**: Officer age in years
- **Officer Race**: Officer race, as indicated by membership (0 = "No"; 1 = "Yes") in any of eight U.S. Census-designated race and ethnicity groups (Asian, American Indian or Alaska Native, Black/African American, Hispanic or Latino, Native Hawaiian or Pacific Islander, white, multiracial, or unknown)
- **Total Hours Worked**: Total hours worked to date
- **Unit Count**: Count of officer's unit assignments

Unless it was the outcome of the analysis, the count of promotions, highest rank achieved, complaints, and gross wages earned were also included as covariates.

Review of Methodology

OIG found three limitations in SPD's analysis that may have affected the accuracy of results:

1. Nonlinearity of the rank variable;
2. Misspecification of the covariance matrix; and
3. Framing gender as a causal variable.

Nonlinearity of the Rank Variable

When calculating propensity score weights, SPD used a 20-point scale (Table 2) ranking each officer's position from 1 ("Police Recruit") to 20 ("Chief of Police").

Table 2. Numeric Ranking of Positions Within the Seattle Police Department

Rank	Position	Rank	Position
1	Police Recruit	11	Police Lieutenant (Acting)
2	Police Student Officer	12	Police Lieutenant
3	Police Officer (Probationary)	13	Police Captain (Acting)
4	Police Officer	14	Police Captain
5	Police Officer Detective (Acting)	15	Assistant Chief (Acting)
6	Police Officer Detective	16	Assistant Chief
7	Police Sergeant (Acting)	17	Interim Deputy Chief of Police
8	Police Sergeant	18	Deputy Chief of Police
9	Police Sergeant Detective (Acting)	19	Interim Chief of Police
10	Police Sergeant Detective	20	Chief of Police

Propensity scores are calculated using a statistical method called logistic regression. In the present application, the logistic regression model would estimate the probability an officer is a woman based on the numeric rank variable. For example, the model might estimate that each one-unit increase in rank corresponds to a two percent decrease in the probability an officer is a woman.

Logistic regression models assume a linear (i.e., constant) rate of change.[31] Continuing with the previous example, the probability that a Police Student Officer is a woman must be two percent lower than the probability a Police Recruit is a woman, and so on through each subsequent ascent.

However, OIG found the probability an officer is a woman does not decrease at a constant rate throughout the numeric rank scale.[32] As a result, SPD's analysis may not have effectively controlled for rank, leaving residual confounding by rank in the estimated effects of gender on career outcomes.

31 Olowe, K. J., Edoh, N. L., Zouo, S. J. C., & Olamijuwon, J. (2024). Comprehensive review of logistic regression techniques in predicting health outcomes and trends. *World Journal of Advanced Pharmaceutical and Life Sciences, 7*(2), 16–26.

32 Results of a Box-Tidwell test indicated that the highest rank achieved variable did not conform to the assumption of linearity of the logit, $\beta = —.46$, $p < .01$.

Misspecification of the Covariance Matrix

SPD's logistic regression model estimates changes in probability from multiple predictor variables. This set of variables is the "covariance matrix." OIG identified three areas of concern in the covariance matrices used in SPD's logistic regression models: multicollinearity, endogeneity, and overfitting.

Multicollinearity occurs when predictors in the covariance matrix are redundant. Multicollinearity is assessed by calculating correlations. Correlations, which range from 0 to 1, measure how closely changes in one variable are associated with changes in another variable. Higher absolute values indicate stronger correlations. Inverse correlations, where increases in one variable are associated with decreases in the other, are denoted with a minus (-) sign.

Table 3 presents correlations among predictors in covariance matrices of models that generated propensity scores to estimate disparities between men and women in complaints, promotion count, and highest rank achieved. If two variables in the same model are strongly correlated, the model cannot determine which variable is associated with change in the outcome of interest. As shown in Table 3, the correlation between dollars earned and hours worked is high (r = 0.93), as is the correlation between CAD and I/O Report Counts (r = 0.75).

Table 3. Correlations Among Variables in the Covariance Matrix

	CAD Count	Highest Rank	I/O Report Count	Dollars Earned	Hours	Max Comp. Rate
CAD Count	1.00					
Highest Rank	-0.14	1.00				
I/O Report Count	**0.75**	-0.14	1.00			
Dollars Earned	0.27	0.56	0.16	1.00		
Hours Worked	0.35	0.41	0.23	**0.93**	1.00	
Max. Comp. Rate	0.09	0.68	-0.04	0.68	0.56	1.00

Note. Correlations with absolute values greater than >0.7 are considered moderate to high.[33] These correlations are presented in bold font.

The variance inflation factor (VIF) is another assessment of multicollinearity. Variance inflation factors greater than five indicate overlaps among variables that endanger the accuracy of findings.[34] OIG calculated variance inflation factors for all covariates in Table 2 and found evidence of multicollinearity (14.06 and 9.29 for Dollars Earned and Hours Worked, respectively). These high VIFs indicate that the Dollars Earned and Hours Worked variables are highly correlated with other variables within the covariance matrix. Multicollinearity can lead to incorrect calculations of propensity scores.[35]

Endogeneity occurs when predictors themselves constrain the range of outcomes. In SPD's analysis, the maximum compensation rate and hours worked variables constrain gross earnings. Employees who have higher hourly compensation and work more hours earn more throughout their careers. By controlling for these variables in the covariance matrix, the analysis assumes that differences between men's and

33 Akoglu, H. (2018). User's guide to correlation coefficients. *Turkish Journal of Emergency Medicine, 18*(3), 91–93.

34 Menard, S. (2001). *Applied Logistic Regression Analysis*. Sage Publications.

35 Menard (2001).

women's gross compensation are unrelated to hours worked and maximum compensation rate. This strategy ignores a plausible explanation: these disparities exist not despite but because of differences in hours worked and maximum compensation rate.

Overfitting occurs when irrelevant predictors are included in the model. Overfitting can artificially inflate or deflate propensity scores.[36] SPD's propensity score calculations predicted gender from eight binary (0 = "No", 1 = "Yes"), mutually exclusive race and ethnicity variables based on U.S. Census categories (Asian, American Indian or Alaska Native, Black/African American, Hispanic or Latino, Native Hawaiian or Pacific Islander, white, multiracial, or unknown). These variables' inclusion would be permissible if gender were related to race or ethnicity. However, a person's race or ethnicity has no relevance to their sex assignment at birth or gender identity development. Thus, adjusting for the effect of race on gender identity is not justifiable.

Framing Gender as a Causal Variable

Using demographic characteristics such as gender in causal inference models demands careful consideration.[37] Propensity score methods classify individuals as "treated" or "untreated." In SPD's analysis, being female is considered "treatment." The propensity score method simulates equality on all characteristics except gender so that any difference in outcomes can only be attributed to gender.

This approach risks violating the stable unit treatment value assumption (SUTVA).[38] Treating gender as a causal variable challenges all three conditions of SUTVA:

1. Every subject experiences the same treatment;
2. How treatment is achieved does not affect outcome; and
3. One subject's treatment status does not affect another subject's outcome.

Gender is not well-suited for examination under these conditions. Gender roles are not absolutes. People display masculinity and femininity in different ways, so "treatment" status is not equal for all women. For conditions (1) and (2) to be met, a person's classification as male or female would need to matter more than how masculine or feminine they are. However, masculinity and femininity exist on spectrums, and more stereotypically feminine employees encounter greater workplace discrimination.[39,40]

In addition, framing gender as causative blurs the line between gender itself and others' responses to it. Harassment is not an inevitable experience for women; rather, harassment is the result of men's sexism at the interpersonal and institutional levels.[41,42] Returning to SUTVA's terminology, the treatment status of male officers is affecting outcomes of female officers, violating condition (3).

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36 Schuster, T., Lowe, W.K., and Platt, R.W. (2016). Propensity score model overfitting led to inflated variance of estimated odds ratios. *Journal of Clinical Epidemiology, 80*, 97–106.

37 Kohler-Hausmann, I. (2019). Eddie Murphy and the dangers of counterfactual causal thinking about detecting racial discrimination. *Northwestern University Law Review, 113*(5). 1163–1228.

38 SUTVA was first articulated by Donald Rubin, the developer of propensity score methods. Rubin cautioned against using demographic variables such as gender in a 1986 commentary in the *Journal of the American Statistical Association*, "Which Ifs Have Causal Answers?".

39 Bem, S.L. (1974). Bem Sex Role Inventory. J*ournal of Personality and Social Psychology*.

40 Heilman, M.E. (2012). Gender stereotypes and workplace bias. *Research in Organizational Behavior, 32*, 113–135.

41 Heilman, M.E., Caleo, S., & Manzi, F. (2024). Women at work: Pathways from gender stereotypes to gender bias and discrimination. *Annual Review of Organizational Psychology and Organizational Behavior, 11*. 165–192.

42 Riddle, K., & Heaton, K. (2023). Antecedents to sexual harassment of women in selected male-dominated occupations: A systematic review. *Workplace Health and Safety, 71*(8), 356–365.

Appendix B: Methodology for OIG Analysis

OIG analyzed HRIS data from 2,131 sworn officers within SPD. Data were extracted from the Internal Affairs Professional (IAPro) system and supplemented with information from the SPD Data Analytics Platform (DAP).

Variables

Gender

Gender was coded as a binary variable (0 = "Male", 1 = "Female") in accordance with SPD's methodology. Employee gender was retrieved from the DAP. Fewer than five officers identified as non-binary, genderqueer, or gender-nonconforming. Due to this small count, OIG could not infer conclusions about the experiences of these officers and excluded them from analysis.

Complaints

All complaints originating from officers and civilians against each officer, regardless of sustainment, were extracted from the DAP. Complaints were summed by origin.

Employment Duration

For analyses of wages and overtime hours, employment duration was calculated as years elapsed since baseline (i.e., an employee's start date at SPD or January 1, 2013, when SPD began storing employee data in its HRIS). When considering employment duration as an outcome of officer gender, OIG calculated the difference between the month, day, and year of hire and departure. If the officer was still employed with SPD, the departure date was the date when analysis was performed.

Hourly Wages and Overtime Hours

Hourly wages were calculated with information from the DAP. The DAP distinguishes compensated activities (e.g., regular, overtime, sick or vacation leave) by hours expended and compensation rate. Within each calendar year (January 1–December 31), OIG calculated an employee's average hourly wage by dividing their total regular wages by their total regular hours worked. Overtime hours were ascertained from the same source and summed for employees within each year.

Special Unit

OIG categorized employees' assignment to a special unit as of March 2025 using a binary variable (0 = "Not in Specialized Unit", 1 = "In CRG or SWAT"). Unit assignments were retrieved from IAPro.

Analytic Strategy

Descriptive Statistics

OIG provided counts of officers by gender along with means and standard deviations of employment duration.

Wages

OIG used a hierarchical linear model (HLM) to determine whether baseline wages and rate of wage growth over employment duration varied between male and female officers.[43] Hierarchical linear modeling is commonly used in repeated measures experiments, where multiple outcomes (e.g., hourly

43 Bryk, A.S., & Raudenbush, S.W. (1992). *Hierarchical Linear Models: Applications and Data Analysis Methods*. Sage Publications.

wages in each calendar year) belong to the same subject.[44] In broad terms, the hierarchical linear model simultaneously estimates within-subject change over time (i.e., the rate of change over time expressed as a regression coefficient, akin to slope m in the slope-intercept linear equation $y = mx + b$) and between-subject variance. The model simultaneously estimates between-subjects effects: that is, characteristics that differ among subjects that could explain variance, or diversity of values, for intercept b and slope m.

HLMs are often referred to as *multilevel models* because they simultaneously calculate coefficients at various levels of analysis (e.g., between- and within-subject). At the first (within-subject) level, the model estimates Y_{ij} using this equation for each subject i at each timepoint j:

$$Y_{ij} = \beta_{0j} + \beta_{ij}X_{ij} + e_{ij}$$

Where:

- Y_{ij} is the value of officer j's hourly wage at timepoint i.
- B_{0j} is the value of the officer's hourly wage when i = 0 (i.e., the baseline, or starting measure).
- β_{ij} is the increase in Y_{ij} for every one-unit increase in X_{ij}; here, it is the increase in hourly wages over a 12-month period.
- e_{ij} is the error: the discrepancy between the estimated value of Y_{ij} and its actual value.[45]

At the second (between-subject) level, two equations estimate the regression coefficients of B_{0j} and β_{ij}:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}G_j + U_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}G_j + U_{1j}$$

Where:

- β_{0j} and β_{1j} are the intercept and slope of officer j's hourly wage trajectory, respectively.
- G_j is the value of the between-subject variable; in this case, G is gender (0 = "male", 1 = "female").
- γ_{00} is the "grand mean" hourly wage where G = 0 (i.e., for all men). Specifically, it is each individual officer's wage averaged across all time points, and then the average of those averages among all officers.
- γ_{01} is the effect of G; when added to γ_{00}, it yields an analogous grand mean value when G = 1 (i.e., for all women).
- γ_{10} is the mean slope value for all officers where G = 0 (i.e., for all men).

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44 Woltman, H., Feldstain, A., MacKay, C.J,, and Rocchi, M. (2012). An introduction to hierarchical linear modeling. *Tutorials in Quantitative Methods for Psychology, 8*(1), 52–69.

45 Consider the previously discussed slope-intercept equation $y = mx + b$. In algebra, one often uses this equation to generate a line of best fit for a series of (x, y) coordinates. The line of best fit minimizes the distance between the actual values of those coordinates and the trajectory of the line. That difference between where the line travels and the coordinates it estimates is, in statistical terms, known as error and expressed here as e_{ij}.

- γ_{11} is the effect of G; when added to γ_{10}, it yields the mean slope value for all officers where G = 1 (i.e., for all women).
- U_{0j} and U_{1j} are analogous to the error term, representing the difference between officer j's estimated and actual β_{0j} and β_{1j} values. Because γ_{00}, γ_{01}, γ_{10}, γ_{11} are fixed effects whose values are the same for all subjects, the inclusion of these two terms allows individual officers' baseline salaries and salary trajectories to vary.

Prior to fitting the HLM, OIG randomly selected 20 employees using a random seed generator to verify that employee wages demonstrated linear (i.e., non-polynomial) changes over time. OIG also fit unconditional means and growth models to verify that within- and between-person variance and annual change in wages were sufficient to justify further analysis. OIG excluded from analysis all officers who departed SPD less than three years after their hire date because three measurements are required to estimate within-person changes stably.[46]

Complaints

OIG used a negative binomial regression model to identify whether an officer's complaint count over the course of their career differed as a function of gender. OIG determined that a negative binomial regression model was necessary due to overdispersion of the count data. OIG controlled for assignment to a special unit using the binary special unit indicator. OIG did not evaluate whether gender moderated the effect of special unit assignment on complaints because too few women were assigned to special units.

Overtime

Overtime opportunities are determined not only by an officer's capacity, willingness, and experience but also department needs and community events, both of which are uncontrollable. Such uncontrollability means an officer's overtime assignments may not increase or decrease consistently (i.e., linearly) over time.

To account for the nonlinearity of overtime assignments, OIG used a hierarchical generalized additive model (HGAM), an adaptation of the HLM that relaxes the assumption of linearity. The HGAM predicted the number of overtime hours worked in a calendar year (January 1–December 31) from an officer's gender throughout the course of their employment. Mathematically, an HGAM is expressed as:

$$g\left(\mathbb{E}\left[Y_{ij}\right]\right) = \beta_0 + f_1\left(X_{ij}\right) + f_2\left(X_{ij},\ by = G_j\right) \ldots + b_j + \epsilon_{ij}$$

Where:

- g is a link function (i.e., identity).
- B_0 is the intercept.
- f values are smoothing functions, which is the product of a regression coefficient and basis function.
  - $f_1\left(X_{ij}\right)$ is a global slope function that estimates change over time in overtime opportunities for all officers.
  - $f_2\left(X_{ij},\ by = G_j\right)$ describes the deviation of officers from f_1 based on their group assignment G_j. In this context, the group assignment is gender.
- b_j and ϵ_{ij} are random effects.

46 Bryk and Raudenbush (1992).

Length of Career

OIG performed a time-to-event (survival) analysis to compare time elapsed (in years) before departure of men and women using a log-rank comparison of Kaplan-Meier curves. Officers who had departed SPD were considered censored.

Highest Rank Achieved And Number Of Promotions

OIG hypothesized that highest rank achieved and number of promotions would be highly correlated with hourly compensation. In contrast to hourly wage data, SPD's rank variable was ordinal, which would call for a more complex analytic procedure (e.g., ordered logistic regression) with a less accessible interpretation.[47] For this reason, OIG sought to omit analyses of outcomes involving rank. To test whether such an omission was justifiable, OIG conducted a Spearman's rank order correlation to compare SPD's ranking of positions with their associated mean hourly wages (as of 2025). If OIG discovered a strong correlation, then OIG would omit analyses with highest rank achieved and number of promotions as outcomes to avoid redundancy.[48]

Results

Descriptive Statistics

OIG analyzed data from 2,264 sworn officers (85.3% male). The mean career length of officers was 21.53 years (*SD* = 10.70 years).

Wages

OIG randomly selected 20 employees and verified that employee wages exhibited linear changes over time. Results of unconditional means and growth models respectively revealed a substantial intraclass correlation coefficient (*ICC* = 0.49) and a significant effect of employment duration ($b = 2.10$, $p < .001$). Together, these preliminary results indicated that a hierarchical linear model was an appropriate strategy for analyzing wage data.

Results of an HLM (Table 4) assessing the effects of officers' gender and years of employment on salary growth revealed that men's mean baseline salary was $41.14. The difference between men's and women's baseline salaries was not statistically significant. With each year of employment, men's and women's hourly wages increased by $2.14 and $1.82, respectively, a difference that was statistically significant ($p = .013$).

47 James (2024).

48 i.e., ±0.7, see Akoglu (2018).

Table 4. Results of HLM Analysis of Wage Data

	Model 1: Unconditional Means Model	Model 2: Unconditional Growth Model	Model 3: Full Model
Fixed Effects, *b (SE)*			
Intercept	49.09*** (0.24)	41.03*** (0.23)	41.14*** (0.25)
Years Employed		2.10*** (0.25)	2.14*** (0.05)
Gender (1 = Female)			-0.74 (0.64)
Gender × Years Employed			0.32* (0.13)
Random Effects, Variance			
Intercept (Subject)	9.84	9.07	9.07
Years Employed		1.64	1.64
Intercept-Years Employed Covariance		-0.31	-0.31
Residual	10.32	6.59	6.59
Model Fit			
ICC	0.48		
AIC	124673.30		114075.64
BIC	124696.35		114121.75
Log-Likelihood	-62333.65		-57031.82
Marginal R^2	0.00		0.22
Conditional R^2	0.48		0.79

Note. *p < .05, **p < .01, ***p < .001. ICC = intraclass correlation coefficient; AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion. Baseline time is January 1, 2013, or hire date, whichever occurred later.

Complaints

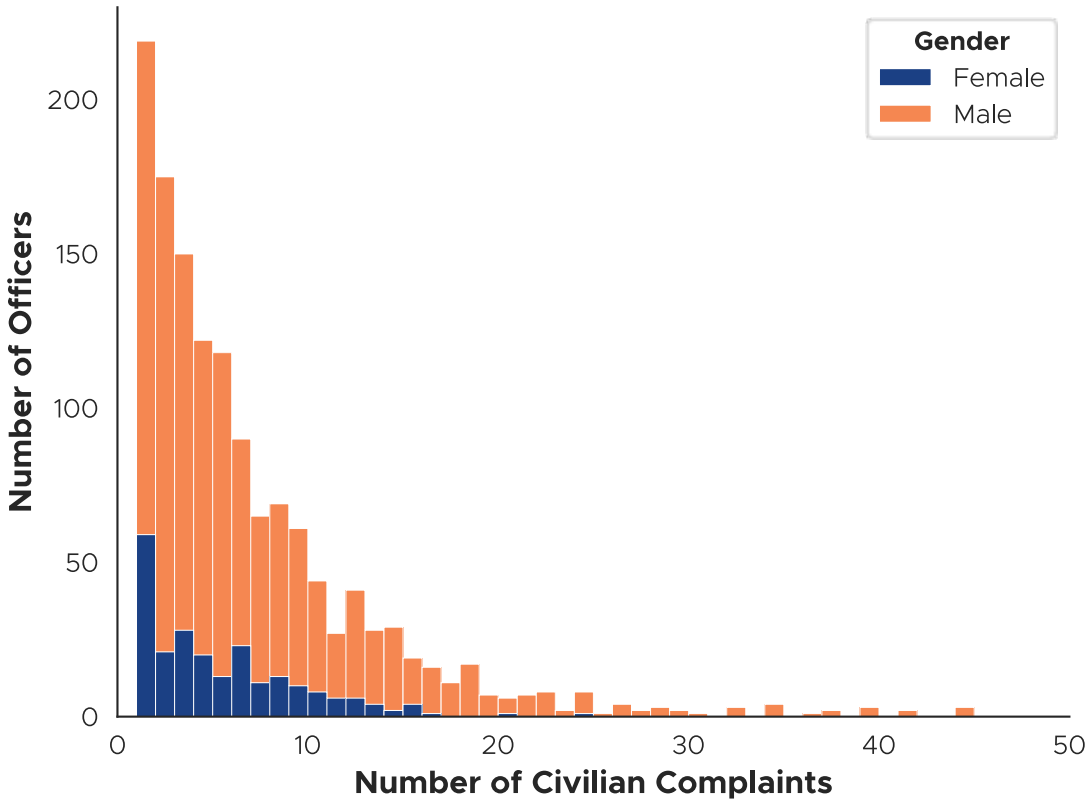
Because count data were overdispersed (mean = 3.90, variance = 28.64), OIG used a negative binomial regression model to analyze complaints as a function of gender. Results of the negative binomial regression are presented in Table 5. Men were more likely to be named in complaints from civilians (*OR* = 1.19, p = .005) but not other officers (*OR* = 1.03, p = .530). Officers assigned to special units were also more likely to be named in complaints from civilians (*OR* = 2.19, p < .001) but not other officers (*OR* = 1.0, p = .662). Figure 2 displays the counts of complaints as a function of gender.

Table 5. Results of Negative Binomial Regression Analysis of Complaints

Predictor	b	SE	Z	OR
Complaints from Officers				
Intercept	*b* = 0.81***	0.06		
Male Gender	*b* = 0.03	0.06	0.53	1.03
Member of Special Unit	*b* = 0.08	0.11	0.66	1.08
Alpha	*b* = 0.11***	0.02		
Complaints from Civilians				
Intercept	*b* = 1.69***	0.06		
Male Gender	*b* = 0.17**	0.06	2.78	1.19
Member of Special Unit	*b* = 0.78***	0.11	7.01	2.19
Alpha	*b* = 0.57***	0.03		

Note. *$p < .05$, **$p < .01$, ***$p < .001$.

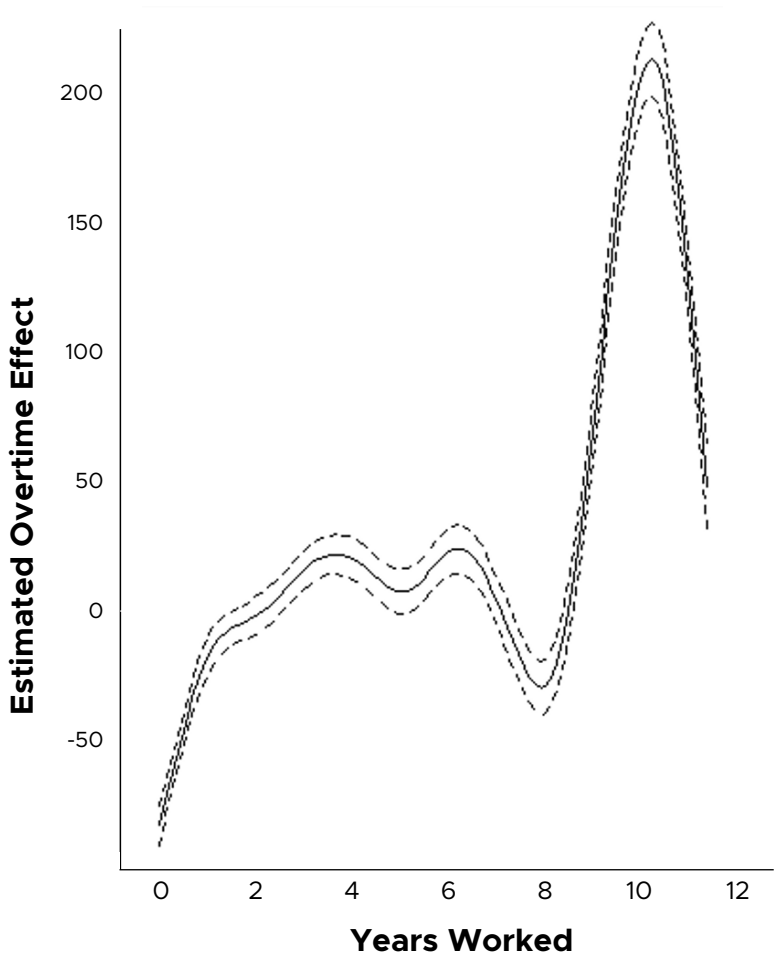
Figure 2. Number of Civilian Complaint Counts by Gender



Overtime

Results of the HGAM (Table 6) assessing the effects of gender and years of employment revealed that men and women worked 243 and 151 overtime hours at baseline ($p < .001$). After accounting for possible non-linear trends in overtime hours, OIG could not conclude that women's overtime hours changed over the course of their careers ($p = .156$). By contrast, employment duration was related to overtime opportunities for men ($p < .001$). Visual inspection of the smooth trajectory revealed that men's overtime hours increased steadily during their first three years of employment, remaining stable until slightly declining around the seventh year of employment, and increasing dramatically between their eighth and tenth years of employment (Figure 3).

Figure 3. Smooth Trajectory of Overtime Hours for Male Officers at SPD



Note. The smooth trajectory displays the estimated overtime effect as a function of years employed at SPD. The estimated overtime effect is the difference from the average annual overtime taken by all men employed as officers at SPD; thus, zero indicates mean overtime taken. In comparison to all men employed as officers, those with less than two years of experience take fewer overtime hours than their more senior peers. By contrast, male officers with eight to 10 years of experience take more overtime than junior male officers.

Table 6. Results Of Hierarchical Generalized Additive Model (Hgam) Analyzing Overtime Hours By Gender

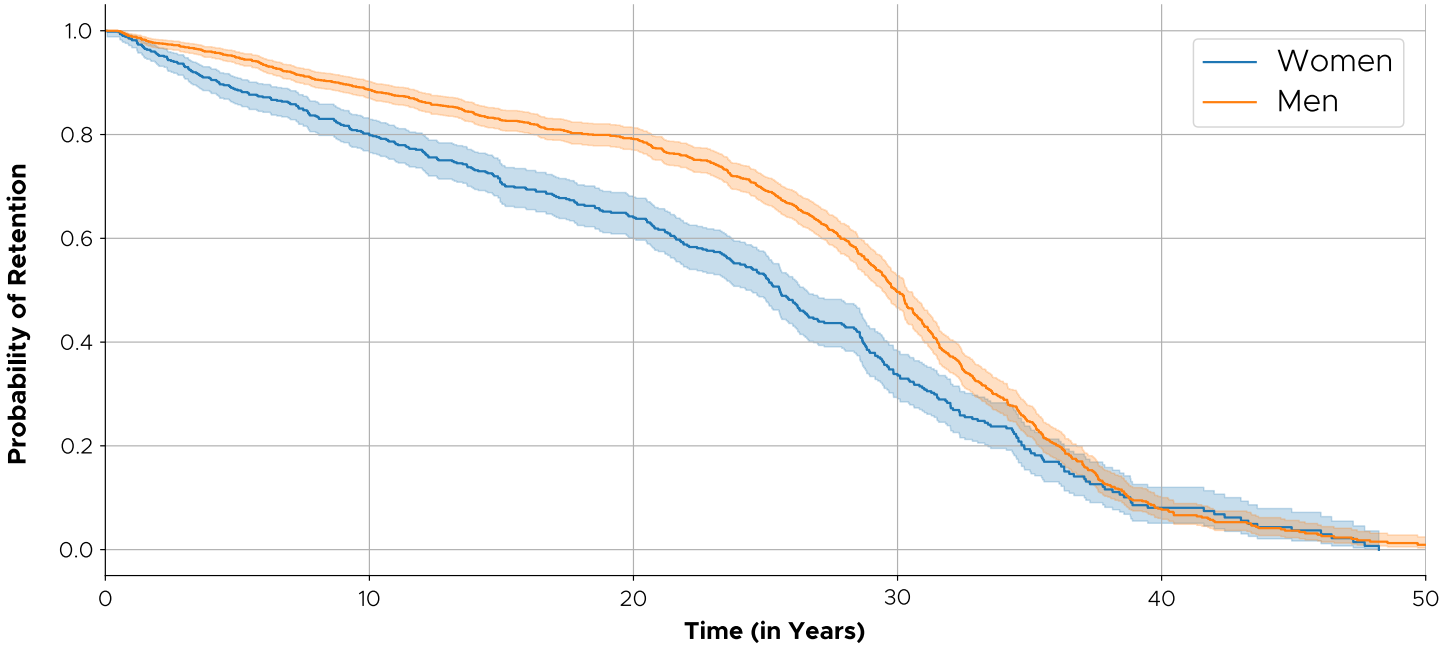
Effect Type	Predictor	Estimate	SE	F	Reference DF
Fixed	Intercept	*b* = 151.23***	6.50		
Fixed	Gender (1 = Female)	*b* = 92.24***	7.63		
Fixed	Years Worked × Gender = 0	*b* = -210.65***	25.43		
Fixed	Years Worked × Gender = 1	*b* = -63.67	44.85		
Smooth	Years Worked × Gender = 0			8.21	8.21
Smooth	Years Worked × Gender = 1			8.90	8.90
Random	Intercept	*SD* = 163.85			
Residual	—	*SD* = 167.05			

Note. *p < .05, **p < .01, ***p < .001.

Length of Career

Results of the time-to-event analysis indicated that the median career lengths for male and female officers were, respectively, 29.9 and 25.5 years. The difference was significant, $\chi^2(1) = 27.94$, $p < .001$. Figure 4 displays the probability (Kaplan-Meier curve) an officer has been retained by SPD as a function of that officer's duration of employment, in years, as a function of gender.

Figure 4. Kaplan-Meier Curve of Officer Retention as Function of Gender



Highest Rank Achieved and Number of Promotions

Results of the Spearman's rank order correlation test between SPD's ranking of positions and their associated salaries revealed a strong correlation, $\rho(8) = 0.98$, $p < .001$. The strong correlation justified omitting separate analyses of highest rank achieved and number of promotions.

Appendix C: Seattle Police Department Response

Thank you for the time that went into reviewing SPD's 30x30 quantitative analysis and for conducting your own independent analysis. We really appreciate the depth of the work and the findings in both analyses.

The report offers valuable insight into gender based differences in career outcomes at SPD, particularly around wage growth, overtime, complaints, and retention. Your analysis highlights a few important areas where SPD can continue to improve, including:

- Taking a closer look at promotion timing and advancement pathways, especially given the differences in wage growth over time.
- Better understanding how overtime access, assignment practices, and informal procedures may shape career development opportunities.
- Focusing on retention and workplace culture, particularly factors that may be contributing to shorter career tenure for women.
- Continuing to consider how gender diversity can positively impact community trust and perceptions.

We view this report as a constructive resource that helps point to where our analyses, policies, and practices can be strengthened in support of the 30x30 Initiative. SPD is committed to reviewing the findings carefully and incorporating them into our ongoing efforts around equity, accountability, and transparency.

Thank you again for the thoughtful work and for your partnership. We look forward to continuing the work with OIG as this effort moves forward.