

Case Western Reserve University
Candidate Pool Study: Tracking Gender and Racial Diversity of
Faculty Searches during 2001-2006

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June 2008

Executive Summary

Research Purpose: Candidate pools reflect the applicants considered for new faculty hires, and represent an opportunity to promote diversity in the hiring of new faculty. This study was undertaken to assess the diversity and outcomes of faculty searches occurring in science and engineering (S&E) departments within Case Western Reserve University (CWRU).

Methods: All faculty searches for full-time faculty conducted in 31 S&E departments across 4 schools at CWRU from Academic Year (AY) 2001-02 to AY2006-07 were included. Searches for visiting faculty, lecturers, and research-only faculty were excluded from the study. Searches were also excluded if a full search was not done due to promotion of an internal candidate. Paper files housed in the University's Office of Equal Opportunity and Diversity were reviewed for each eligible search. Information collected included the school, department, and year of the search, as well as the number of candidates in the total search and short list by gender, and the gender, rank and tenure status, and decision of hire. Percentage female and male applicants in each search were calculated. Stratified analyses of each search's candidate pool, short list, offer(s), and hire were performed by gender and race, respectively. A linear regression analysis was performed to assess the relationship between candidate pool diversity and short list representation of female candidates and of under-represented minority candidates. In addition, a logistic regression analysis was performed to assess the effect of candidate pool and short list diversity on hiring a female candidate or underrepresented minority (URM) candidate.

Results: A total of 193 searches were identified in the study, representing 9055 candidates, of which 985 candidates advanced to the short list for their respective searches. Overall, females composed 15.9% of the candidate pools, 30.7% of the short lists, and 38.7% of the offers for hire. When stratified by race, URM candidates composed 2.3% of the candidate pools, 3.8% of the short lists, and 5.2% of the hires. There is a linear relationship between percent females (positive) and percent males (negative) in the candidate pool on female representation on the short list. A linear relationship also exists between percent URM candidates in the candidate pool and URM representation on the short list. The proportion of females on the short list is significantly related to the likelihood of hiring a female. The proportion of URM candidates on the short list is significantly related to the likelihood of selecting an URM candidate.

Recommendations:

- (1) To diversify the faculty body, improve faculty search procedures to systematically expand candidate pools and shortlists to include women and underrepresented minority faculty.
- (2) Improve and institutionalize the collection of data on candidate pools for each faculty search conducted at the University.
- (3) Expand this study beyond science and engineering (S&E) searches.

INTRODUCTION

Candidate pools reflect the applicants considered for new faculty hires, and represent an opportunity to promote diversity in the hiring of new faculty. With the advent of the NSF ADVANCE program at Case Western Reserve University (Academic Careers in Engineering and Science – ACES), a policy was implemented requiring the dean of each school to assess and approve the lists of candidates for each faculty search for diversity during the recruitment stage prior to entering the selection stage. This study was undertaken to assess the diversity and outcomes of faculty searches occurring in S&E departments within CWRU.

At the time this study was proposed, there was no established mechanism to collect and analyze the candidate pool diversity of faculty searches at the University. Faculty search files were being stored, but the information contained within the files had not been entered into a database or analyzed in any way. This lack of information made identification of baseline levels of candidate pool diversity, temporal trends, and school-level differences of outcomes difficult to ascertain. The current study was undertaken in this context, to perform institutional research on candidate pool gender and racial diversity and its attendant outcomes.

This report will provide background describing issues related to candidate pool diversity, state the methods used in this study, present descriptive results of faculty searches according to gender and to race. Statistical testing of regression analyses will be reported. Lastly, a discussion of the main findings, their implications, and recommendations will be provided.

RESEARCH QUESTIONS

Given the strategic importance of faculty diversity and the importance of search and hiring policies and practices that best harness such diversity, our study seeks to answer the following two main research questions: First, what is the effect of candidate pool gender and racial composition on short list gender and racial composition? This question will be answered by a linear regression analysis. Second, are female and racial minority candidates more likely to be hired when there are a greater number of females on the short list or in the candidate pool? This question will be addressed by a logistic regression analysis.

METHODS

Permission was obtained from CWRU’s Office of Equal Opportunity and Diversity, and approval was granted by the University’s Institutional Review Board to review files of completed faculty searches containing information regarding the composition of the candidate pool, short list, and hiring outcomes for faculty searches. Data from the paper files were entered into a database developed for the project in SPSS. Analysis of the data was performed in SPSS.

Sampling Criteria

Faculty searches from 31 S&E departments in four schools participating in the ACES program were included in the study. A list of participating schools and departments is included in Table 1. In addition, only faculty searches resulting in a faculty hire with a start date from AY 2001-02 through AY 2006-07 were included. AY 2007-08 searches were not included, as these searches are still ongoing though the summer. The study also limited faculty searches by rank, including only searches for instructors, assistant professors, associate professors, and professors. Lastly, the study included only searches for full-time faculty positions. Searches resulting in a visiting faculty appointment, a short-term appointment, or a summer appointment were excluded. Searches resulting in the hire of research-only faculty (i.e. Research Associate Professor) were also excluded.

Table 1: CWRU Schools and Departments participating in the ACES program

School	Departments
College of Arts and Sciences	Anthropology Astronomy Biology Chemistry Geological Sciences Mathematics Physics Political Science Psychology Sociology Statistics
Case School of Engineering	Biomedical Engineering Chemical Engineering Civil Engineering Electrical Engineering & Computer Science Macromolecular Science Materials Science & Engineering Mechanical and Aerospace Engineering

Case School of Medicine	Anatomy Biochemistry Genetics Microbiology Neurosciences Pharmacology Physiology & Biophysics RNA
Weatherhead School of Management	Economics Management Info. Operations Research Organizational Behavior MAPS

Variables

Continuous variables included in the database for each search are: total number of candidates, total female candidates, total male candidates, total candidates of unknown gender, and number of male and female candidates by race (Native American, Asian, Hispanic, Black, White, and Unknown race); number of short list candidates, number of female short list candidates, number of male short list candidates, number of short list candidates of unknown gender, and number of male and female short list candidates by race (Native American, Asian, Hispanic, Black, White, and Unknown race).

Categorical variables included in the database for each search are as follows: Academic Year of anticipated start date, School and Department conducting the search, Gender of hire, Rank of hire, Tenure status of hire, Candidate’s decision (accept offer/reject offer/withdrew candidacy/not listed).

Derived variables used for regression analysis include: Percent candidates in search who are female; percent candidates in search who are male; percent candidates in short list who are female; and percent candidates in short list who are male. In addition, a summary variable was created representing all Under-Represented Minority (URM) candidates: Black, Hispanic, and Native American.

Statistical analysis

Descriptive statistics and stratified analysis were undertaken first. Then, a linear regression analysis was performed, with percent of females in the short list as the dependent variable. Predictor variables in the model were: Percent candidates in search who are female;

percent candidates in search who are male. This second predictor variable was included because a third variable, percent candidates of unknown gender, could only be known if percent males and females in the candidate pool were known; thus, if percent female were not included, one would not be able to know from percent male alone what remaining proportion of the candidates were female. A logistic regression analysis was also performed, with gender of hire as the dependent variable. Predictor variables included in model were: Percent candidates in search who are female; percent candidates in search who are male; percent candidates in short list who are female; and percent candidates in short list who are male. In this case, at the short list level the gender of all candidates was known, and thus only one gender needed to be included in the regression model. The same such approach was taken to develop linear and logistic models by race, using the derived-variable Under-Represented Minority as the dependent variable: Hired or not for logistic regression, and percent URM candidates in short list for linear regression. The predictor variables included only percent URM candidates, percent white candidates, and percent Asian candidates in the candidate pool and for the linear regression, and percent URM candidates in the candidate pool and in the short list for the logistic regression. Stepwise-backward modeling was performed in the linear regression model, and stepwise-forward modeling was performed in the logistic regression model. Goodness-of-fit was assessed according to Hosmer-Lemeshow test, with $p > .05$ indicating a good fit. Comparison of linear regression models was assessed by R-square value. Comparison of logistic regression models were assessed by subtracting the -2 Log likelihood ratio from the baseline model to the model with predictor variable added. Significance was measured by $p\text{-value} \leq .05$ associated with the Wald Chi-square statistic. Measure of effect is based on B and/or $\text{Exp}(B)$ to yield an odds ratio. 95% confidence intervals of the measure of effect were determined.

RESULTS

Overall Findings

By Gender

Based on the selection criteria, 193 faculty searches were identified in the 31 S&E departments at CWRU from AY 2001-02 to AY 2006-07, totaling 9055 applicants. As seen in Table 2-A, females represented 15.9% of the candidate pool, males 55.6%, and candidates of unknown gender composed 28.5% of the pool. 985 candidates reached the level of the short list.

In the short list, females comprise 30.7% of the candidate pool, males 68.8%, while candidates of unknown gender compose only 0.5% of the short list. Female candidates were offered 75 of the 193 faculty positions, or 38.9%, while male candidates were offered the remaining 118 positions, 61.1% of the total.

Table 2-A: Demographics by Gender

	Candidate Pool	Short List	Hires
Females	1439 (15.9%)	302 (30.7%)	75 (38.9%)
Males	5031 (55.6%)	678 (68.8%)	118 (61.1%)
Unknown	2585 (28.5%)	5 (0.5%)	0 (0%)
Total	9055	985	193

By Race

At the candidate pool level, as seen in Table 2-B, search committees were unable to identify the race of the majority of applicants, over 55% of the time. Of the remaining candidates in the candidate pool classified by race, a quarter of them are White, and 16% are Asian. Under-represented minority candidates collectively represent 2.3% of the candidate pool.

At the short list level, search committees, aided by campus interviews, were better able to identify the race of candidates, with under 15% unknown race. The decrease in unknown race of candidates was mirrored by an increase in the proportion of candidates classified by race. The majority of short list applicants are White, comprising over 60% of the short list. Asian candidates represent 21% of the short list. Under-represented minority candidates increased in proportion marginally from 2.3% of the candidate pool to 3.8% of the short list.

At the offer level, given closer contact with applicants, search committees were able to identify the race of applicants more accurately, over 92% of the time. As Table 2-B shows, the majority of offers for hire went to White candidates, nearly 70% of the time. Asian candidates were offered positions nearly 18% of the time, while Under-represented minority candidates were offered 5.2% of the positions.

Table 2-B: Demographics by Race

	Candidate Pool	Short List	Hires
Asian	1119 (16.4%)	205 (21%)	34 (17.6%)
Black	64 (0.9%)	14 (1.4%)	4 (2.1%)
Hispanic	79 (1.2%)	22 (2.3%)	5 (2.6%)
Native American	16 (0.2%)	1 (0.1%)	1 (0.5%)
Under-Represented Minority (Black, Hispanic, and Native American Candidates combined)	159 (2.3%)	37 (3.8%)	10 (5.2%)
White	1731 (25.4%)	591 (60.6%)	134 (69.4%)
Unknown	3796 (55.8%)	143 (14.7%)	15 (7.8%)
Total (Candidates in which gender known)	6805	976	193

By Department

The number of faculty searches conducted by each department is presented in Table 3-A.

Table 3-A: Number and Percent of S&E Faculty Searches at CWRU by Department, AY 2001-02 to AY 2006-07

School	Department	Frequency	Percent
CAS	anthropology	2	1
	astronomy	1	0.5
	biology	10	5.2
	chemistry	3	1.6
	geosciences	3	1.6
	mathematics	7	3.6
	physics	7	3.6
	political science	7	3.6
	psychology	9	4.7
	sociology	1	0.5
	statistics	2	1
CSE	biomedical engineering	14	7.3

School	Department	Frequency	Percent
	chemical engineering	8	4.1
	civil engineering	1	0.5
	electrical engineering/CS	14	7.3
	mechanical engineering	4	2.1
SOM	anatomy	6	3.1
	biochemistry	7	3.6
	genetics	18	9.3
	molecular biology/microbiology	9	4.7
	macromolecular S&E	3	1.6
	neurosciences	10	5.2
	pharmacology	6	3.1
	physiology/ biophysics	11	5.7
	RNA	2	1
WSOM	information systems	4	2.1
	economics	5	2.6
	marketing and policy studies	11	5.7
	operations research	4	2.1
	organizational behavior	4	2.1
	Total	193	100

Seven “growth” departments were identified that each conducted at least 5% of the total number of faculty searches. These seven growth departments are as follows: Physiology & biophysics, biomedical engineering, electrical engineering & computer science, marketing & policy studies, genetics, biology, and sciences. These 7 departments, comprising less than 23% of the 31 S&E departments, accounted for nearly 46% of the faculty searches (see Table 3-B).

Table 3-B: Number and Percent of S&E Faculty Searches at CWRU Occurring in 7 Growth* Departments, AY 2001-02 to AY 2006-07

*Growth department defined as conducting greater than 5% of total S&E faculty searches from AY 2001-02 to AY 2006-07

School	Department	Frequency	Percent of Total Searches
CAS	biology	10	5.2
CSE	biomedical engineering	14	7.3
	electrical engineering/CS	14	7.3

SOM	Genetics	18	9.3
	physiology/ biophysics	11	5.7
	Neurosciences	10	5.2
WSOM	marketing and policy studies	11	5.7
	Total	88	45.7

Regression analysis

LINEAR REGRESSION

Gender

Linear regression was performed to assess the relationship between candidate pool composition and short list composition, first by gender and then by race. The first linear regression, displayed in Table 4, shows a significant linear relationship of both percent female and percent male candidates at the candidate pool stage on percent female candidates at the short list stage. The percent of females on the short list increases as the percent of females in the candidate pool increases, and decreases as the percent of males in the candidate pool increases.

Table 4: Linear Regression-Effect of Candidate Pool Gender Composition on Female Representation on the Short List

	Adjusted R squared	F	df	p
Model summary	0.597	141.5	(2, 188)	0.000

Variable	B	SE	t	p
constant	0.315	0.047	6.733	0.000
Percent males in Candidate Pool	-0.251	0.057	-4.43	0.000
Percent females in Candidate Pool	0.753	0.066	11.378	0.000

Dependent variable: Percent females in Short List

$$Y=0.315 + 0.753(\% \text{ females in candidate pool}) -0.251(\% \text{ males in candidate pool})$$

Race

The second linear regression, shown in Table 5, assesses the effect of candidate pool racial composition on the degree of URM representation on the short list.

The dependent variable, percent URM candidates on short list, statistically significantly increases as the percent of URM candidates in the candidate pool increases.

Table 5: Linear Regression-Effect of Candidate Pool Racial Composition on URM Short List Representation

	Adjusted R squared	F	df	p
Model summary	0.479	58.6	(3, 185)	0.000

Variable	B	SE	t	p
constant	0.016	0.013	1.283	0.201
Percent Asian candidates in pool	-0.035	0.031	-1.123	0.263
Percent URM candidates in pool	1.463	0.112	13.1	0.000
Percent White candidates in pool	-0.024	0.02	-1.189	0.236

Dependent variable: Percent URM candidates in short list

LOGISTIC REGRESSION

Gender

In a crosstab preliminary analysis, there were two faculty searches in which gender was unknown in the short list. Therefore, these observations were deleted, resulting in a logistic regression with 191 faculty searches.

Percent males in the candidate pool, percent females in the candidate pool, and percent females on short list are used as predictors of the gender of new hire. It should be noted that percent of applicants with unknown gender in the candidate pool and percent males on short list were not used as predictors, since they are derived variables, calculated by 1- other predictors included at the candidate pool- and short list-level.

In stepwise fashion variables were added, starting with the intercept, which was significant, with a -2 Log Likelihood Ratio of 254, and a Wald Chi Square of 10.003 with p value= 0.002 at 1 df. The model with predictors added is significant overall, with -2 Log Likelihood Ratio of 170, a Wald Chi Square of 82.68 with p=0.000 at 3df. The Hosmer and

Lemeshow Test is not significant with a Chi-square of 7.78 with p value=0.455 at 8df, indicating that the model fits the data appropriately.

Table 6 describes the results of the regression analysis. It shows the coefficients (B), their standard errors, the Wald Chi-square statistic, associated p-values, and odd ratio (Exp(B)). Only % of female on the short list is statistically significant, while % of female and % of males in the pool are not.

Table 6: Logistic Regression analysis predicting gender of hire based on candidate pool and short list composition by gender, AY 2001-02 to AY 2006-07

n=191			Chi-square	df	p	R square
Overall Model			83.348	3	0.000	0.481
H-L Goodness of Fit			7.78	8	0.455	

Variable	B	SE	Wald	df	p	Exp(B)
Percent males in Candidate Pool	-0.118	0.835	0.02	1	0.888	0.889
Percent females in Candidate Pool	1.071	1.285	0.695	1	0.405	2.918
Percent females in Short List	-6.695	1.259	28.258	1	0.000	0.00124
Constant	2.704	0.771	12.296	1	0.000	14.932

Dependent variable: Hiring a female faculty member.

Note: Due to SPSS internal recoding of outcome, must take inverse of ratio $\text{Prob}[(\text{Hiring a Male})/(\text{Hiring a Female})] = e^{14.932 - 0.00124(\% \text{ female in short list})}$

Taking the log of this number, and then taking the inverse of this number, provides one with the percent female expected to be hired with the given proportion of females on short list.

The interpretation of the coefficient can be understood as follows: for every one unit increase in % of female on short list, the likelihood of hiring a male instead of hiring a female will decrease. Conversely, the likelihood of hiring a female will increase. Thus, as the proportion of females on the candidate pool increases, so does the likelihood of hiring a female candidate in a faculty search. The magnitude of this effect is small, but the results are statistically significant.

The regression equation is as follows:

$$\text{Prob}[(\text{Hiring a Male})/(\text{Hiring a Female})] = e^{14.932 - 0.00124(\% \text{ female in short pool})}$$

Taking the log of this number, and then taking the inverse of this number, provides one with the percent female expected to be hired with the given proportion of females on the short list.

Race

As shown in Table 7, Logistic Regression analysis was used to predict hire of an Under-represented minority faculty member based on URM candidate pool and short list composition from AY 2001-02 to AY 2006-07. The dependent variable was the hiring an Under-represented minority faculty member. The regression model is as follows:

$$\text{Prob}[(\text{Hiring a URM})/ (\text{Not hiring a URM})] = e^{0.014+4198(\% \text{ URM in short list})}$$

Taking the log of this number provides one with the ratio of URM to non-URM candidates expected to be hired with the given proportion of URMs on short list. The inverse provides the probability of hiring a non-URM candidate. $1 - p(\text{non-URM hire}) = p(\text{URM hire})$. This logistic regression shows that the likelihood of hiring a URM candidate significantly increases as the percentage of URM candidates on the short list increases. The model is a good fit, with Hosmer Lemeshow test not significant.

Table 7: Logistic Regression analysis predicting hire of an Under-represented minority faculty member based on URM candidate pool and short list composition, AY 2001-02 to AY 2006-07

n=189			Chi-square	df	p	R square
Overall Model			31.071	2	0.000	0.447
H-L Goodness of Fit			1.48	2	0.572	

Variable	B	SE	Wald	df	p	Exp(B)
Percent URM candidates in pool	8.801	5.794	2.308	1	0.129	6643.72
Percent URM candidates in short list	8.343	3.006	7.703	1	0.006	4198.82
Constant	-4.255	0.612	48.275	1	0.000	0.014

Dependent variable: Hiring an Under-represented minority faculty member

$$\text{Prob}[(\text{Hiring a URM})/ (\text{Not hiring a URM})] = e^{0.014+4198(\% \text{ URM in short list})}$$

Taking the log of this number provides one with the ratio of URM to non-URM candidates expected to be hired with the given proportion of URMs on short list. The inverse provides the probability of hiring a non-URM candidate. $1 - p(\text{non-URM hire}) = p(\text{URM hire})$.

Summary of Main Findings

- A statistically significant linear relationship exists between the percent of female and URM applicants in the candidate pool and their degree of inclusion on the short list. This finding represents the strongest evidence to support casting a broad and diverse net when conducting faculty searches, and to defer moving the search process to the next stage until a greater proportion of female and URM applicants have been included.
- The level of representation of female and URM applicants on the short list is associated with likelihood of hiring a female or URM candidate. For female candidates, this effect was statistically significant but results in only a marginal increase in the likelihood of hiring a female. For race, even a small increase in under-represented minority candidates on the short list has a profound effect on the likelihood of hiring an under-represented minority candidate; however, this may be due in part to small sample size, as there were only 10 offers made to under-represented minority candidates in S&E departments at CWRU over the 6-year period from AY 2001-02 to AY 2006-07.

CONTRIBUTIONS AND LIMITATIONS

Our study contributes to understanding about gender and diversity in organizations by adding to extant understanding of faculty search practices and outcomes occurring at research universities. To the best of our knowledge, this is the first study to have undertaken a systematic review of the search and hiring practices and outcomes at Case Western Reserve University.

Our data have some limitations, however. First, during AY 2004-05 and beyond, the university introduced a number of procedural changes relevant to the conduct and monitoring of faculty search and hiring practices, providing intensive educational efforts to enhance the diversity of candidate pools. However, the adoption and implementation of these new procedures varied by department. Further, not all the 31 departments availed of the opportunities for such education about the new procedures at the same time, and thus some departments may have had less time to make meaningful changes in the way their faculty searches are conducted. Second, the number of candidates with unknown gender in our dataset is exceedingly high. Systematic attempts to identify the gender of candidates would improve the reliability of the findings. Third, the current analysis does not stratify outcomes by school and year since the cell sizes would be

too small for meaningful comparisons. With a larger population of universities studied or a greater portion of the schools and departments at CWRU included, it would be useful to track departmental or school-level changes. Finally, since the study focused on the faculty search and hiring practices and outcomes of a single private university, generalizability of the data to other universities deserves further exploration. Along the same lines, as this study was undertaken in only 31 science and engineering departments within 4 of the University's 9 schools, these findings may not be generalizable to other schools and departments at the University.

IMPLICATIONS FOR PRACTICE

Our findings suggest that by increasing the diversity of candidates in early stages in the faculty search process, hiring outcomes may be diversified; diversity in candidate pools impacts the gender of the candidate offered a position. The implications of this finding are to urge faculty search committees to deliberately widen their candidate pools, and increase the number of women and minority candidates brought into campus for interviews.

RECOMMENDATIONS

(1) Improve faculty search procedures to systematically expand candidate pools and shortlists to include women and underrepresented minority faculty. Although central to increasing faculty diversity, which is of strategic importance to universities, faculty search and hiring practices have been relatively understudied. We recommend that specific steps be undertaken, including modification of search procedures (e.g., where and how advertisements appear, how candidates are sought, the inclusion of a non-discrimination statement in the advertisement, standardization of questions asked during the interviews whether in-person or virtual, inclusive procedures during the campus visits, whom the candidate meets during the campus visit, etc.), special diversity-awareness training and education to search committee members, knowledge of disciplinary candidate pools in the nation, specialized assistance throughout the recruitment and hiring process, and search committee toolkits and training incorporating these findings.

(2) Improve and institutionalize the collection of data on candidate pools for each faculty search conducted at the University, and (3) expand the study beyond S&E. As this study represents institutional research of value to the University, we recommend institutionalization of

this activity to continue annual data collection and analysis of candidate pool diversity and hiring outcomes. In addition, we recommend broadening the scope of data collection to include faculty searches in all schools and departments at the university. As the collection of data into a usable format is a labor intensive process involving review of paper files and data entry into a computerized database, it would be helpful to explore IT solutions for tracking faculty search data and outcomes, whether developed in-house or with external assistance. Other ADVANCE institutions are working on development of such faculty search data-collection systems, and may serve as a resource for IT solutions to track the diversity of faculty searches. To create a diverse faculty body, we urge the future research efforts and administrative attention be focused on systematically understanding candidate pool diversity in faculty searches and outcomes.