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Becoming a Professor: an Analysis of Gender on the Promotion of Faculty from Associate to Full Professor

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ABSTRACT
Factors associated with the promotion of associate professors to full professor were evaluated at a land-grant university in the United States of America. In univariable analyses, gender (female), field of study (non-STEM) and highest degree held (non-doctoral) were all associated with decreased odds of being promoted from associate professor to full professor. However in an adjusted analysis, only the highest degree held by the individual seeking promotion and field of study remained associated with promotion from associate professor to full professor. Male and female faculty with non-doctoral degrees in non-STEM fields had similar but decreased odds of promotion to full professor from associate professor. These data indicate that after adjusting for the highest degree held by the individual seeking promotion and the field of study, there was no evidence that gender was associated with decreased odds of promotion from associate to full professor.

KEYWORDS
promotion, STEM, associate professor, gender, highest degree

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INTRODUCTION

Associate professor in the United States (US) is a mid-career academic rank between assistant and full professor, and increasingly there is interest from higher educational institutions to understand the career progression experiences of faculty at this rank. Several reports have suggested that faculty may remain in the associate professor rank for longer than expected and that women remain in the associate professor rank longer than men (MLA, 2009, Zakian et al., 2003). Dependent upon the institution, the field and the individual, faculty might be expected to request promotion to full professor somewhere between 3 and 13 years after promotion to associate processor. Although some articles report large gender differences in the time taken to be promoted to full professor, few studies appear to evaluate factors, other than gender, that may be associated with these differences. For example, area of study, i.e., STEM (science, technology, engineering, and mathematics) versus non-STEM and highest degree held by the individual faculty member are also likely to be associated with promotion success (National Research Council, 2010a).

The question of whether women have a different promotion experience in academia than men is a common one, and is reviewed in a recent National Research Council report (National Research Council, 2010a). For questions about promotion and tenure in lower academic ranks, the data may be more conflicting. However, with respect to promotion to full professor, the results from multiple studies are consistent i.e., after adjusting for other factors gender does not appear to be associated with promotion to full professor. The National Research Council report "Gender Differences in Careers of Science, Engineering and Mathematical Faculty" reported that after adjustment for disciplinary differences, department size, and use of stop-the-clock policies, time in associate professor rank and success of promotion to full professor (once proposed) did not differ between men and women (National Research Council, 2010b). Similarly, Ginther and Khan reported that, with or without covariate adjustment, gender was not associated with promotion to full professor (Ginther & Khan, 2009).

The objective of the study was to provide a clearer understanding of the interaction between these three factors, namely gender, field of study and highest degree obtained, with promotion to full professor at a Midwestern US university. Understanding potential confounders and effect modifiers of the association between gender and promotion would allow administrators to identify and address the sub-groups that may benefit from interventions to ensure successful transition from associate professor to full professor. The study was particularly interested in investigating whether, after adjusting for field of study (STEM or non-STEM), there is an association between gender and length of time to promotion to full professor.

METHODS AND MATERIALS

This section starts by giving some contextual information about the institution in which the study took place and its promotion procedures. Iowa State University (ISU) is a public land-grant institution in the Midwest region of the United States of America. The institution's mission is to serve the state, region, country and international community though teaching, research and extension. Faculty are based in 8 colleges: College of Agriculture and Life Sciences, College of Business, College of Design, College of Engineering, Graduate College, College of Human Sciences, College of Liberal Arts and Sciences, College of Veterinary Medicine, and the Library.

The processes for promotion at ISU are described in the ISU faculty handbook and administered by the Office of the Executive Vice President and Provost. The ISU Faculty Handbook, including the sections on Promotion and Tenure are available on-line[1] . Successful promotion requires assessment and recommendations from the faculty member's home department, college and the Office of the Executive Vice President and Provost.

The current ISU faculty handbook reports that faculty should be promoted based on evidence of scholarship in their areas of responsibility. At ISU faculty have appointments that may include responsibility in teaching, research, professional practice, outreach and service. The faculty handbook provides a great deal of material about what scholarship means. The definition of scholarship at ISU is also available on line in the ISU faculty handbook.

The qualifications for promotion to full professor at ISU are also included in the ISU faculty handbook and are as follows :

> " A professor should be recognized by his/her professional peers within the university, as well as nationally and/or internationally, for the quality of the contribution to his/her discipline. The candidate must demonstrate the following:
> • national distinction in scholarship, as evident in candidate's wide recognition and outstanding contributions to the field or profession
> • effectiveness in areas of position responsibilities
> • significant institutional service.
>
> Furthermore, a recommendation for promotion to professor must be based upon an assessment, since the last promotion, that the candidate has made contributions of appropriate magnitude and quality and has demonstrated the ability to sustain contributions to the field or profession and to the university."

SOURCE DATA AND STUDY POPULATION

Data for the study were obtained with institutional approval (IRB 10-611) from the ISU Office of Responsible Research. The source data for this study consisted of two datasets. One dataset (the promotion dataset) contained information about all faculty members who were employed at Iowa State University (ISU) at some time between the fall semester of 1990 and the fall semester of 2008. Some faculty

were employed prior to 1990 (the earliest from 1951). At ISU demographic information about the faculty employed is obtained in October for the fall semester and March for the spring semester each year.
Faculty members who were employed between 1990 and 2008 were contained in this dataset, and the data about their positions are referred to as the promotion data. Variables included in this dataset were: the year a faculty member was hired, rank at the time of hire, dates of subsequent academic rank promotions and tenure dates, gender, citizenship, highest degree, and ethnicity. A second dataset (the termination dataset) contained data about all faculty who had left ISU for any reason (resignation, retired, died) within the last 20 years. Some employees included in that dataset had been employed at ISU since 1931.

The data for analysis, that is the study population, were obtained by combining the termination and promotion datasets. The two datasets were used to create the analysis dataset, however some manipulation of data was required to exclude non-relevant faculty such as faculty hired above the assistant professor rank, who where excluded because their time in the associate professor rank at other institutions was not known. All faculty who had left ISU were not in the analysis dataset. The final dataset contained the study population of interest, i.e. faculty who had come to ISU as assistant professors and had been promoted to associate professors and were still employees of ISU in fall 2008 (n= 742).

VARIABLE MANIPULATION

The combined dataset contained variables that described gender, ethnicity, citizenship, highest degree at time of appointment, year of appointment to assistant professor, year of appointment to associate professor, year of appointment to full professor. Several new variables were created, (1) a continuous variable describing the number of years since promotion to associate professor, (2) a polychotomus categorical variable that identified promotion cohorts, i.e., a group of individuals who were promoted in the same period of years (Table 1 – see Appendix), (3) a continuous variable describing the number of years between promotion to associate professor and full professor when applicable, (4) a polychotomous categorical variable describing the periods for promotion (Table 2 - see Appendix), (5) a dichotomous categorical variable -full professor in 2008 (yes/no), (6) a dichotomous categorical variable –promoted to full professor within 5 years of becoming associate professor (yes/no), (7) a dichotomous categorical variable – promoted to full professor within 8 years of becoming associate professor (yes/no), and (8) a dichotomous categorical variable –promoted to full professor within 12 years of becoming associate professor (yes/no). These categorizations were arbitrarily chosen, as they seemed to the authors to classify early, standard and delayed promotion to full professor based on experience at ISU.

STATISTICAL ANALYSIS

For the descriptive analysis, the frequency distribution and percentage of the categorical variables were determined for the subgroups gender and field of study (STEM or non-STEM). For the descriptive analysis all categories of the explanatory variables were used: ethnicity (5 levels), highest degree (4 levels) and citizenship (3 levels). Note that the ISU data also had a field category which had three levels.

The 1st level was STEM disciplines (defined by the ISU ADVANCE Program as the natural and agricultural sciences, and Veterinary Medicine). Non-STEM fields at ISU are further divided into Social and Behavioral Sciences (SBS) and a third category for all the other disciplines at ISU. This category includes disciplines that are not STEM or SBS, such a humanities, business, art/design, and those faculty employed at the ISU Parks Library. The prevalence ratios in 2008 for the main variables of interest, gender and field of study, were calculated.

To achieve the study objective, separate hypothesis-testing analyses were conducted. The first analysis, referred to as the "full cohort" analysis, aimed to evaluate the association between successful transition to full professor within either 5, 8 years or 12 years of promotion to associate professor. The two explanatory variables of interest were gender and field of study. For this analysis, the outcome of interest was rank at the end of the specified time period. The analysis tested whether gender and/or field of study were associated with successful transition to full professor and length of time to successful transition.

The second analysis, referred to as the "promoted cohort" analysis, evaluated the association between successful transition to full professor within either 5, 8 years or 12 years of promotion only for those faculty members who did (eventually) make full professor. Again the two explanatory variables of interest were gender and field of study. The hypothesis tested by this analysis was whether gender and/or field of study were associated with differences in time to promotion among those who are successfully promoted.

The approach to analysis was logistic regression. The hypothesis test in the logistic regression tested if the odds ratio was equal to 1, and the Wald chi-square test p value less than 0.05 was used to indicate a significant association. The measure of association reported from the univariable logistic regression model was the unadjusted odds ratio. For multivariable models, the measure of association was the adjusted odds ratio. Deviations from the mean coding were used for coding dummy variables. The interpretation of the odds ratio is the odds of being currently full professor in the comparison group compared to the odds of being full professor in the referent group. For example, if the variable of interest is field of study, and the p value is greater than 0.05, this implies that the data are consistent with the odds ratio being 1 i.e., there is no evidence to reject the null hypothesis that the odds of faculty in STEM fields (comparator) being full professor are different from the odds of faculty in non-STEM fields (referent) being promoted. If the p value is less than 0.05 and the odds ratio was greater than one, this implies that the odds of faculty in STEM fields being promoted was significantly greater than the odds of faculty in non-STEM fields being promoted. If the p value is less than 0.05 and the odds ratio was less than one, this implies that the odds of faculty in STEM fields being promoted was significantly less than the odds of faculty in non-STEM fields being promoted.

For the "full cohort" analysis, three models were built to evaluate the association between promotion to full professor within either 5, 8 years or 12 years of promotion to associate professor. The outcome variable was either promoted within

5 years (yes/ no), 8 years (yes/no) or 12 years (yes/no). Faculty who were "no" included faculty who were associate professors for the entire period including those faculty who would later become full professors, but at the end of 5 years (8 years or 12 years depending upon the model) were still associate professors. Univariable models were constructed for all explanatory variable of interest.

We also constructed a multivariable logistic model. The model building process was a backward hierarchical model. Full models included the explanatory variables of interest (gender, field of study and highest degree), 2-way interaction terms between gender and field of study, and the covariates ethnicity, citizenship, and promotion cohort. First, the significance of the interaction terms was assessed by removing interaction terms from the model retrospectively when the Wald chi-square test p value was greater than 0.1. Next, potential confounding variables were assessed. Variables were only removed from the model if the p value for the variable Wald chi-square test was greater than 0.05 and if removal of the variable did not result in a meaningful change (greater than 10% change) in the odds ratio estimate for either gender or field of study. Gender and field of study remained in the model regardless of significance. The fit of the final model was assessed using Hosmer and Lemeshow goodness of fit test (Hosmer & Lemeshow, 2001). The null hypothesis for the Hosmer and Lemeshow test was that the model was an appropriate fit, therefore the model was considered to have reasonable fit if the p value was greater than 0.1. The measure of association reported from the multivariable logistic regression model was the adjusted odds ratio.

For the "promoted cohort" analysis, again three models were built to evaluate factors associated with the time to full professor for individuals who did eventually make full professor rank. One model used the outcome "promotion to full professor within 5 years of promotion to associate professor" (within 5 years) with possible values of yes or no. The study population consisted of all full professors who had been eligible for promotion to full professor for at least 6 years**.** Eligibility means that they had been promoted to associate professor at least 6 years prior. At ISU promotion occurs on an annual cycle that begins with submission of an application for promotion some time in Fall each year and, if successful, promotion occurs the following July. We considered that individuals were ineligible to be promoted to full professor for 18 months after promotion to associate professor. Therefore, individuals who were promoted to associate professor between 2002 and 2008 were excluded from the analysis. The rationale for this exclusion was that these individuals had not had the full opportunity to achieve the outcome, i.e., individuals promoted to associate professor in 2006 had only been eligible for 1 year, therefore it was inappropriate to include their data as they still had the opportunity to be promoted within 5 years. The next model used the outcome "promotion to full professor within 8 years of promotion to associate professor" (within 8 years) with possible values of yes or no. Individuals who had not been eligible for promotion for at least 8 years were excluded from the analysis. The next model used the outcome "promotion to full professor within 12 years of promotion to associate professor" (within 12 years) with possible values of yes or no. Individuals who had not been eligible for promotion for at least 12 years were excluded from the analysis. Full models included the explanatory variables of interest: gender, field

and highest degree, 2-way interaction terms between these variables and the covariate ethnicity, citizenship, and promotion cohort. The approach to model building used was exactly the same approach described above.

Observational studies are subject to several sources of bias. We addressed confounding bias using multivariable regression analysis. The reporting of adjusted and unadjusted relative effect measures is designed to enable the reader to be aware of confounding bias between variables of interest. However, it is also possible that important confounders of the association between gender and promotion are missing. Our goal was not to identify all factors associated with promotion to full professor, which would mean we would need to study all factors that affect promotion, rather our goals was to study the association between gender, field of study and promotion. The definition of a true confounder is that it 1) must be related to the exposure variable of interest (gender or field of study), 2) must be associated with the outcome (promotion), and 3) is not an intermediary variable. When interpreting the results, factors that have previously been associated with promotion such as grant success and number of publications should also be taken into consideration as they are also likely to be true confounders of the associations of interest or intermediary variables. Selection bias is also a source of bias. In cohorts like our population, loss-to-follow up (i.e. loss of study subjects in a prospective population) may mean that the source population differs from the study population. In this study, our study population is faculty who were originally hired at ISU as assistant professors, were promoted to associate professors, and remained at ISU, and as such it is a census of those individuals and therefore selection bias is unlikely. The study population is not all faculty who are hired at ISU as assistant professors and clearly we can not make inference about that population. Using the data to make inference about the promotion experience of all faculty hired at ISU as assistant professors is inappropriate because factors that lead faculty to drop out of the population (i.e., to be lost to follow-up) from assistant to associate clearly have a strong influence on the composition of our study population. Misclassification information is another source of bias in an observational study, although is unlikely to have much impact on this study, as most of the explanatory variables are well defined including gender, and field of study.

RESULTS

The frequency distribution of demographic information for the full study population (n=742) are included in Tables 1 through to 7. In the analysis of gender, the prevalence ratio and 95% confidence intervals of full professors to associate professors was 1.64 (95% confidence interval 1.35 to 1.99). This point estimate suggests that the prevalence of full professors among males (313 of 499, 63%) was approximate 60% greater than the prevalence of full professors among women (70 of 183, 38%). The prevalence ratio for STEM versus non-STEM was 1.47 (95% CI 1.26 to 1.72). This point estimate suggests that the prevalence of full professors among those faculty in the STEM fields (270 of 383, 64%) was approximate 50% greater than the prevalence of full professors among those faculty in non-STEM fields (113 of 260, 43%).

For the “full cohort” analysis, the results for evaluating factors associated with promotion to full professor within the 5, 8 and 12 years, models were similar and are presented in Tables 8, 9, and 10 (see Appendix). In each univariable analysis gender was significantly associated with promotion ($p<0.05$), and the odds ratio suggested that men were more likely to be promoted than women. However, for each model, this association did not remain after adjustment for the covariates. For example, in the 5 year model (Table 8 - see Appendix) the adjusted odds ratio for gender was 1.35 (95% confidence interval: 0.79, 2.29). The adjusted odds ratio for the field of study variable was 2.75 (1.75-4.31). There was no significant interaction between field of study and gender ($p=0.95$). Similar results are obvious in Tables 9 and 10 (see Appendix). In each model, the interaction terms were not significant ($p>0.05$), and the fit was assessed to be reasonable ($p>0.1$).

For the “promoted cohort” analysis evaluating factors associated with promotion to full professor within 5, 8 and 12 years again, the results were similar (Tables 11, 12, and 13 - see Appendix). Although gender was consistently statistically significant ($p<0.05$) in univariable analyses, after adjustment for covariates, the association was not observed. In each model, the interaction terms were not significant ($p>0.05$), and the fit was assessed to be reasonable ($p>0.1$).

DISCUSSION

The objective of the study was to provide a clearer understanding of the association and interaction between factors thought to be associated, and for which data were available, with promotion to full professor. The results of the analysis suggest that univariable analyses do not provide a clear picture of the association between gender and promotion in our study population. After adjustment for covariates, gender was not significantly associated with promotion to full professor. The association between gender and promotion changes dramatically after inclusion of covariates in the model. For example, in Table 4 (see Appendix), the unadjusted association suggest the odds of promotion to full professor were 2.6 times greater for men than women, however after adjustment the odds had decreased to 1.3 times and were not significant ($p > 0.05$). Similar changes in association occurred for every model assessed. Highest degree awarded at the time of appointment (doctorate or other) had the strongest relationship with successful promotion in our dataset. When only faculty with doctoral degrees were studied, gender was not a significant factor associated with promotion (results not provided).

These data suggest that gender, field of study, and degree confound each other and the multivariable analysis suggests that after adjustment for confounding, it is the field of study and degree, not gender, that have the stronger relationship with promotion. The variables field of study and degree meet all three *a priori* criteria for a potential confounder and further showed clear evidence of data-based confounding in all the models. There was no evidence that field of study or highest degree act as effect modifiers. The descriptive data in Table 3 illustrate this i.e., 17% of STEM are female and 44% of non-STEM are female. These results re-iterate the importance of multivariable analysis for understanding observational data, as interpretation of unadjusted associations would lead to the conclusion that gender is strongly associated with successful promotion and time to promotion, however it

seems likely that this association is due to the over-representation of women faculty in the non-STEM disciplines (social sciences, humanities, business and design) –especially those that do not require a Ph.D. as the terminal degree (Table 3).

These findings are not novel. As stated in the introduction, the National Research Council report "Gender Differences in Careers of Science, Engineering and Mathematical Faculty" reported that after adjustment for disciplinary differences, department size, and use of stop-the-clock policies, time in associate professor rank and success of promotion to full professor (once proposed) did not differ between men and women (National Research Council, 2010b). Similarly, Ginther & Khan reported that, with or without covariate adjustment, gender was not associated with promotion to full professor (Ginther and Khan, 2009). Although the studies cited differ in the variables assessed and the method of analysis, the consistency of reported association across study types and populations provides strength to the observed association (Rothman and Greenland, 1998).

An interesting finding of the multivariable analysis was the association with promotion cohort and time to promotion. The data suggested that compared to more recent cohorts (i.e., a group of individuals who were promoted in the same period of years) a larger proportion of the cohort promoted to full professor 20 years ago took a shorter time to be promoted. For example, Table 4 suggests that when compared to the cohort promoted more than 21 years ago, the odds of being promoted to full professor within 5 years were 70% less for the cohort promoted 11 to 15 years ago (odds ratio = 0.3) and 60% less for the cohort promoted 16 to 20 years ago (odds ratio=0.4). For the cohort of faculty promoted to associate professor 6 to 10 years ago, the association was not significant, although the point estimate odds ratio is less than one. Similar trends were noted for other models. We are unaware of other studies that have evaluated this factor for associate professors, however other data suggest that the time in assistant professor ranks is lengthening for men and women (National Research Council, 2010b). The reason for the longer time to full professor taken by more recent cohorts is unclear, perhaps different movement out of the cohorts affects the variable or perhaps faculty were promoted to full professor more rapidly 20+ years ago. It would require further investigation to determine if this association is a measure potentially of changing promotion standards.

In the "full cohort" analysis, those faculty with non-doctoral degrees are consistently and significantly less likely to be promoted to full professor. An important issue to bear in mind is that the prevalence of associate professors with non-doctoral final degrees is small (86 of 742, 11.59%), so although the association is strong, this affects a small number of faculty. Degree was not associated with time to full promotion among those promoted to full professor.

In conclusion, the results of the study suggest that, consistent with other studies, gender is not associated with promotion to full professor after adjustment for other factors. As discussed in the introduction, of the few studies that have evaluated gender, the association between gender and promotion to full professor from

associate professor after adjusting for the discipline (in our study classified as STEM and non-STEM) all have reported no association between gender and promotion.

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ENDNOTES

[1] http://www.provost.iastate.edu/faculty/handbook/faculty_handbook/section5.html.

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APPENDIX: Tables 1 – 13

Table 1*: Coding used to identify the promotion cohorts and frequency distribution of 742 faculty employed at Iowa State University as assistant professors who were promoted to associate professors.*

Promoted to associate professor	Number of years prior to 2008	Years since eligible for promotion to full professor	Frequency (%)
2007-2008	Within 1.5 years	Not eligible	60 (8.09%)
2006-2002	2 - 7 years	1-5 years	148 (19.95%)
2001-1997	8 -12 years	6-10 years	98 (13.21 %)
1996-1992	13 -17 years	11-15 years	123 (16.58%)
1991-1987	18 -22 years	16-20 years	117 (15.77%)
1986-1982*	23 - 27 years	21-25 years	87 (11.73%)
1981-1977*	28 - 32 years	26-30 years	44 (5.93%)
prior to 1977*	33+ years	30+ years	65 (8.76%)

* These groups were collapsed for model building as these groups were considered of similar inference i.e., all these promotions occurred a long time ago.

Table 2*: Coding used to identify the time to promotion to full professor (FP) and the frequency distribution of 742 faculty employed at Iowa State University as assistant professors who were promoted to associate professors (AP).*

Years from associate to full	Years in AP rank prior to FP rank	Frequency (%)
Less than 2 years	Immediately post AP	2 (0.27%)
2, 3, 4, 5, 6	Within 1 to 5 years	215 (28.98 %)
7, 8, 9	Within 6 to 8 years	81 (10.92 %)
10, 11, 12, 13	Within 9 to 12 years	55 (7.41%)
14,15,16,17,18,19, 20	Within 13 to 19 years	27(3.64 %)
21 +	20 years after AP rank	3 (0.40%)
Not promoted		359* (48.38%)

*60 faculty might be considered ineligible to be promoted as they were only promoted to associate professor within 18 months of the survey starting.

Table 3*: Frequency and percentage of gender characteristics (% of column) for 742 faculty employed at Iowa State University as assistant professors who were promoted to associate professors.*

Variable	STEM Ψ	Non-STEM	Total (% of group)
Gender			
Female	77 (17%)	128 (44%)	205 (27.63%)
Male	377 (83%)	160 (56%)	537 (72.37%)

Ψ STEM disciplines, as defined by the ISU ADVANCE Program, include natural and agricultural sciences and Veterinary Medicine. Non-STEM fields at ISU include social and behavioral sciences (SBS), humanities, business, art/design, and the faculty employed in the library.

***Table 4**: Frequency and percentage of ISU designated field (% of column) for 742 faculty employed at Iowa State University as assistant professors who were promoted to associate professors.*

Variable	Male	Female	STEM	Non-STEM	Total (% of group)
ISU designated Field Ψ					
STEM	377 (70%)	77 (38%)	454 (100%)	NA	454 (61.19%)
Social Sciences*	58 (11%)	47 (23 %)	NA	105 (36%)	105 (14.15%)
Hum, Bus, Design*	102 (19%)	81 (40%)	NA	183 (64%)	183 (24.66%)

* combined in model building because of spare data.
Ψ ISU data also uses a field category with three levels. The 1st level was STEM disciplines, as defined by the ISU ADVANCE Program, which includes natural and agricultural sciences and Veterinary Medicine. Non-stem fields at ISU are further divided into Social and Behavioral Sciences (SBS) and a third category for all the other disciplines at ISU. This third category includes disciplines that are not STEM or SBS, such as humanities, business, art/design, and the library.

Table 5*: Frequency and percentage of ethnicity characteristics (% of column) for 742 faculty employed at Iowa State University as assistant professors who were promoted to associate professors.*

Variable	Male	Female	STEMΨ	Non-STEM	Total (% of group)
White	444 (83%)	178 (87%)	373 (82%)	249 (86%)	622 (83.83%)
African American*	8 (1.5%)	5 (2%)	3 (0.66%)	10 (3%)	13 (1.75%)
Asian/Pacific Islander*	75 (14%)	18 (9%)	70 (15%)	23 (8%)	93 (12.53%)
American Indian/Alaska Native*	2 (0.5%)	0	1 (0.22%)	1 (0.35%)	2 (0.27)
Hispanic*	8 (1.5%)	4 (2%)	7 (1.54%)	5 (2%)	12 (1.62%)

* combined in model building because of spare data
Ψ STEM disciplines, as defined by the ISU ADVANCE Program, include natural and agricultural sciences and Veterinary Medicine. Non-stem fields at ISU include social and behavioral sciences (SBS), humanities, business, art/design, and the faculty employed in the library.

Table 6*: Frequency and percentage of highest degree held characteristics (% of column) for 742 faculty employed at Iowa State University as assistant professors who were promoted to associate professors.*

Variable	Male	Female	STEMΨ	Non-STEM	Total (% of group)
High D-CD					
Bachelor	2 (0.37%)	0	0	2 (0.65%)	2 (0.27%)
Doctoral	500 (93%)	156 (76%)	440 (97%)	216 (75%)	656 (88.41%)
Masters	29 (5.4%)	43 (21%)	3 (1%)	69 (24%)	72 (9.70%)
Professional	6 (1%)	6 (3%)	11 (2%)	1 (0.35%)	12 (1.62%)

Ψ STEM disciplines, as defined by the ISU ADVANCE Program, include natural and agricultural sciences and Veterinary Medicine. Non-stem fields at ISU include social and behavioral sciences (SBS), humanities, business, art/design, and the faculty employed in the library.

Table 7*: Frequency and percentage of citzenship characteristics (% of column) for 742 faculty employed at Iowa State University as assistant professors who were promoted to associate professors.*

Variable	Male	Female	STEM Ψ	Non-STEM	Total (% of group)
Citizenship					
US Citizen	429 (81%)	178 (87%)	353 (78%)	254 (90%)	607 (82.70%)
Immigrant/permanent resident	78 (15%)	24 (12%)	80 (18%)	22 (22%)	102 (13.90%)
Not a U.S. citizen or permanent resident	23 (4%)	2 (1%)	19 (4%)	6 (2%)	25 (3.41%)

Ψ STEM disciplines, as defined by the ISU ADVANCE Program, include natural and agricultural sciences and Veterinary Medicine. Non-stem fields at ISU include social and behavioral sciences (SBS), humanities, business, art/design, and the faculty employed in the library.

***Table 8**: The association between gender and promotion to full professor within 5 years of promotion to associate professor (n=534)*

Variables		Within 5 years	Not within 5 years	Unadjusted odds ratio	Adjusted odds ratio*
Gender	Male	173 (42%)	234 (58%)	2.61 (1.64-4.15) †	1.35 (0.79-2.29)
	Female	28 (22%)	99 (78%)	referent	referent
Field	STEM	163 (48%)	176 (52%)	3.83 (2.53-5.78) †	2.75 (1.75-4.31) †
	Non-STEM	38 (20%)	157 (80%)	referent	referent
Degree	Doctoral	195 (41%)	278 (59%)	6.43 (2.71-15.23) †	3.38 (1.35 - 8.46) †
	Other	6 (10%)	55 (90%)	referent	referent
Citizenship	US citizen	168 (36%)	302 (64%)	0.52 (0.31-0.88) †	0.54 (0.30-0.96) †
	Other	33 (52%)	31 (48%)	referent	referent
Cohort (*)	6-10 years	39 (40%)	59 (60%)	0.65 (0.39-1.06)	0.63 (0.36-1.09)
	11-15 years	29 (24%)	94 (76%)	0.30 (0.18-0.49)	0.29 (0.17-0.51)
	16-20 years	34 (30%)	83 (70%)	0.40 (0.25-0.65)	0.42 (0.25-0.70)
	21+ year	99 (51%)	97 (49%)	referent	referent

adjusted for gender, field, degree, and promotion cohort
† p value <0.05
* years since promotion to associate

***Table 9**: The association between gender and promotion to full professor within 8 years of promotion to associate professor (n=484)*

Variables		Within 8 years	Not within 8 years	Unadjusted odds ratio	Adjusted odds ratio*
Gender	Male	215 (57%)	165 (43%)	2.36 (1.50-3.70) †	1.37 (0.83-2.26)
	Female	37 (36%)	67 (64%)	Referent	Referent
Field	STEM	184 (60%)	124 (40%)	2.36 (1.61-3.44) †	1.71 (1.13-2.59) †
	Non-STEM	68 (39%)	108 (61%)	Referent	Referent
Degree	Doctoral	242 (56%)	189 (44%)	5.51 (2.69-11.24)†	3.82 (1.79-8.21) †
	Other	10 (19%)	43 (81%)	Referent	Referent
Cohort (*)	8-10 years	24 (50%)	24 (50%)	0.56 (0.29-1.05)	0.58 (0.3-1.13)
	11-15 years	52	71	0.39 (0.24-0.62)	0.46 (0.28-0.75)
	16-20 years	50	67	0.41 (0.25-0.65)	0.47 (0.29-0.76)
	21+ year	121	70	Referent	Referent

adjusted for gender, field, degree, and promotion cohort
† p value <0.05
*years since promotion to associate

***Table 10**: The association between gender and promotion to full professor within 12 years of promotion to associate professor (n=419)*

Variables		Within 12 years	Not within 12 years	Unadjusted odds ratio	Adjusted odds ratio*
Gender	Male	227 (68%)	109 (32%)	2.34 (1.44-3.82)†	1.29 (0.74-2.26)
	Female	39 (47%)	44 (53%)	Referent	Referent
Field	STEM	190 (71%)	77 (29%)	2.46 (1.63-3.73) †	1.79 (1.13-2.82) †
	Non-STEM	76 (50%)	76 (50%)	Referent	Referent
Degree	Doctoral	254 (68%)	121 (32%)	5.59 (2.78-11.25) †	3.93 (1.89-8.27) †
	Other	12 (27%)	32 (73%)	Referent	Referent
Cohort ()	13-15 years	61 (57%)	45 (43%)	0.50 (0.31-0.83) †	0.57 (0.32-0.95) †
	16-20 years	62 (53%)	55 (47%)	0.42 (0.26-0.68) †	0.48(0.28-0.79) †
	21+ year	143 (73%)	53 (27%)	Referent	Referent

adjusted for gender, field, degree, and promotion cohort
† p value <0.05
*years since promotion to associate

Table 11*: The association between gender and promotion to full professor within 5 years who eventually are promoted to full professor (n=367)*

Variables		Within 5 years	Not within 5 years	Unadjusted odds ratio	Adjusted odds ratio*
Gender	Male	173 (57%)	128 (43%)	1.83 (1.07-3.14) †	1.1 (0.59-2.09)
	Female	28 (42%)	38 (58%)	Referent	Referent
Field	STEM	163 (64%)	91 (36%)	3.53 (2.22-5.64) †	3.31 (2.00-5.26) †
	Non-STEM	38 (34%)	75 (66%)	Referent	Referent
Citizenship	US citizen	168 (52%)	153 (48%)	0.43 (0.22-0.85) †	0.41 (0.19-0.86) †
	Other	33 (72%)	13 (28%)	Referent	Referent

adjusted for gender, field, citizenship and promotion cohort
† p value <0.05

***Table 12**: The association between gender and promotion to full professor with 8 years who eventually are promoted to full professor (n=337)*

Variables		Within 8 years	Not within 8 years	Unadjusted odds ratio	Adjusted odds ratio*
Gender	Male	215 (76%)	67 (24%)	1.56 (0.83-2.92)	1.15 (0.57-2.31)
	Female	37 (67%)	18 (33%)	referent	
Field	STEM	184 (80%)	47 (20%)	2.18 (1.31-3.64) †	2.09 (1.22-3.61) †
	Non-STEM	68 (64%)	38 (36%)	referent	

adjusted for gender and field
† p value <0.05

***Table 13**: The association between gender and promotion to full professor with 12 years for faculty who eventually are promoted to full professor (n=305)*

Variables		Within 12 years	Not within 12 years	Unadjusted odds ratio	Adjusted odds ratio*
Gender	Male	227 (88%)	31 (12%)	1.50 (0.64-3.51)	1.04 (0.42-2.56)
	Female	39 (83%)	8 (17%)	referent	
Field	STEM	190 (91%)	19 (9%)	2.63 (1.33-5.20)	2.61 (1.27-5.32) †
	Non-STEM	76 (79%)	20 (21%)	referent	

adjusted for gender and field
† p value <0.05