



RESEARCH CULTURE

Figures and figure supplements

A survey-based analysis of the academic job market

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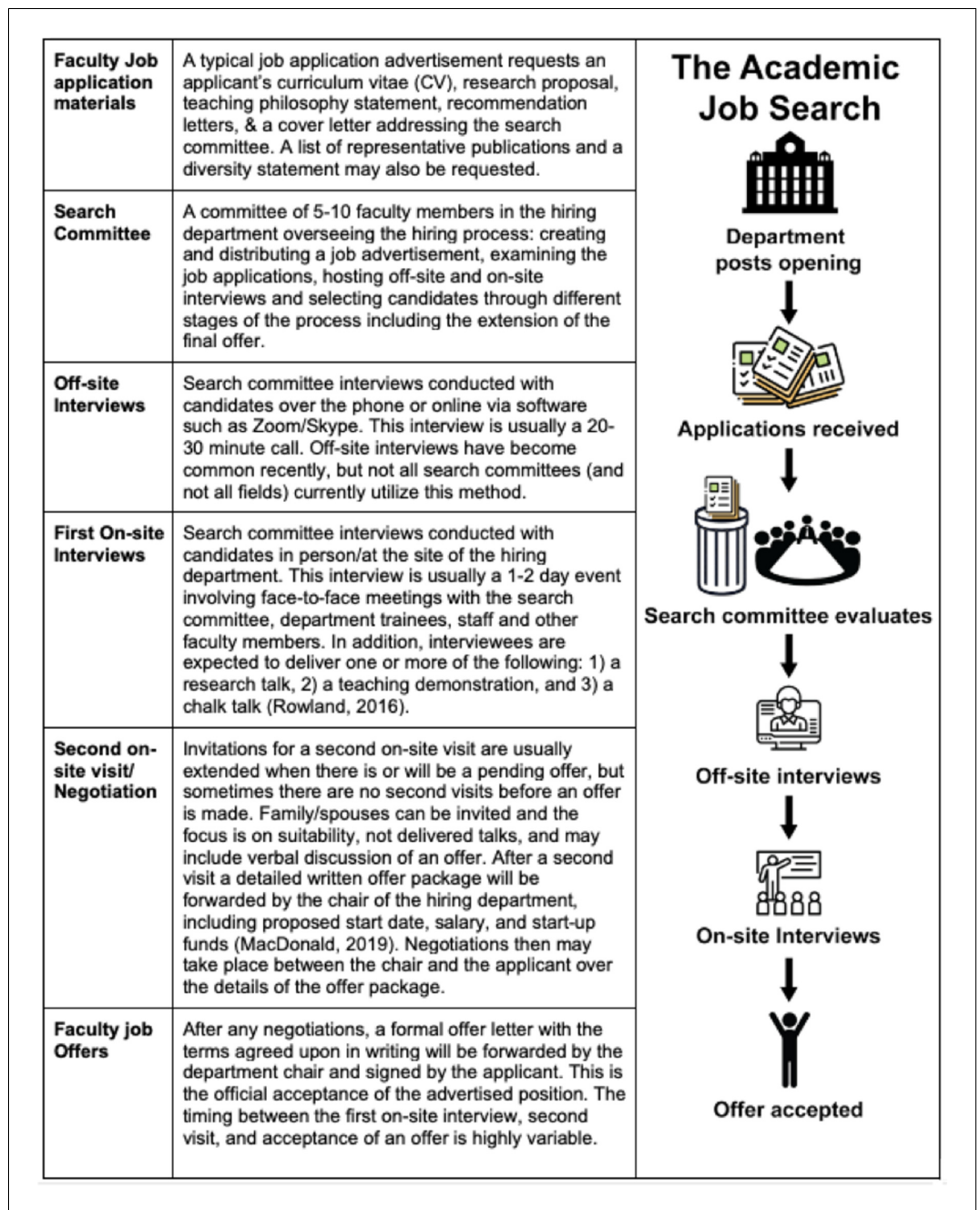


Figure 1. An overview of the academic job search process. The first column defines common terms in the academic job search; while the second column outlines how the search for an academic job progresses, from a job being posted to an offer being accepted.

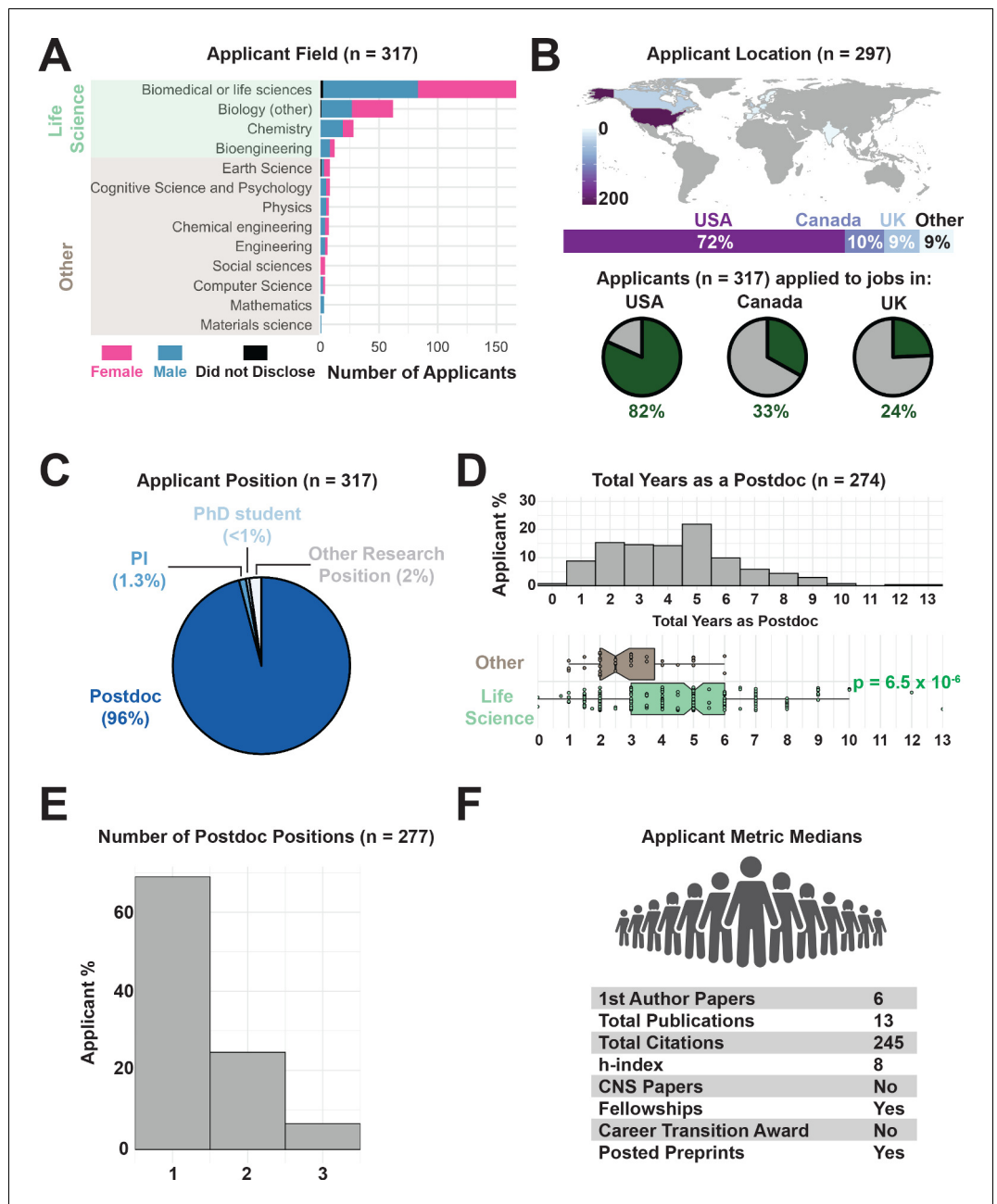


Figure 2. Demographics of academic job applicants. (A) Distribution of survey respondents by self-identified gender and scientific field (**Supplementary file 2**). Fields highlighted in green were grouped together as life-science related fields for subsequent analyses. (B) Distribution of countries where respondents were researching at the time of the survey (top, see **Supplementary file 3**) and the countries in which they applied to faculty jobs (green slices of pie charts, bottom; see **Supplementary file 4**). (C) Self-reported positions of applicants when applying for faculty jobs (**Supplementary file 5**). (D) The number of years spent as a postdoctoral researcher ranges from 1 year or fewer (4% of applicants) to eight or more years (9% of applicants; maximum of 13 years, top). Life-science related postdoctoral training (n = 268 respondents) takes significantly longer than in other fields (n = 49 respondents; $p=6.5 \times 10^{-6}$, bottom; for data see **Supplementary file 6**; for statistical analysis see **Supplementary file 7**). (E) Number of postdoctoral positions held by survey applicants (**Supplementary file 8**). (F) Median values for metrics of research productivity in the applicant pool (**Supplementary file 9**).

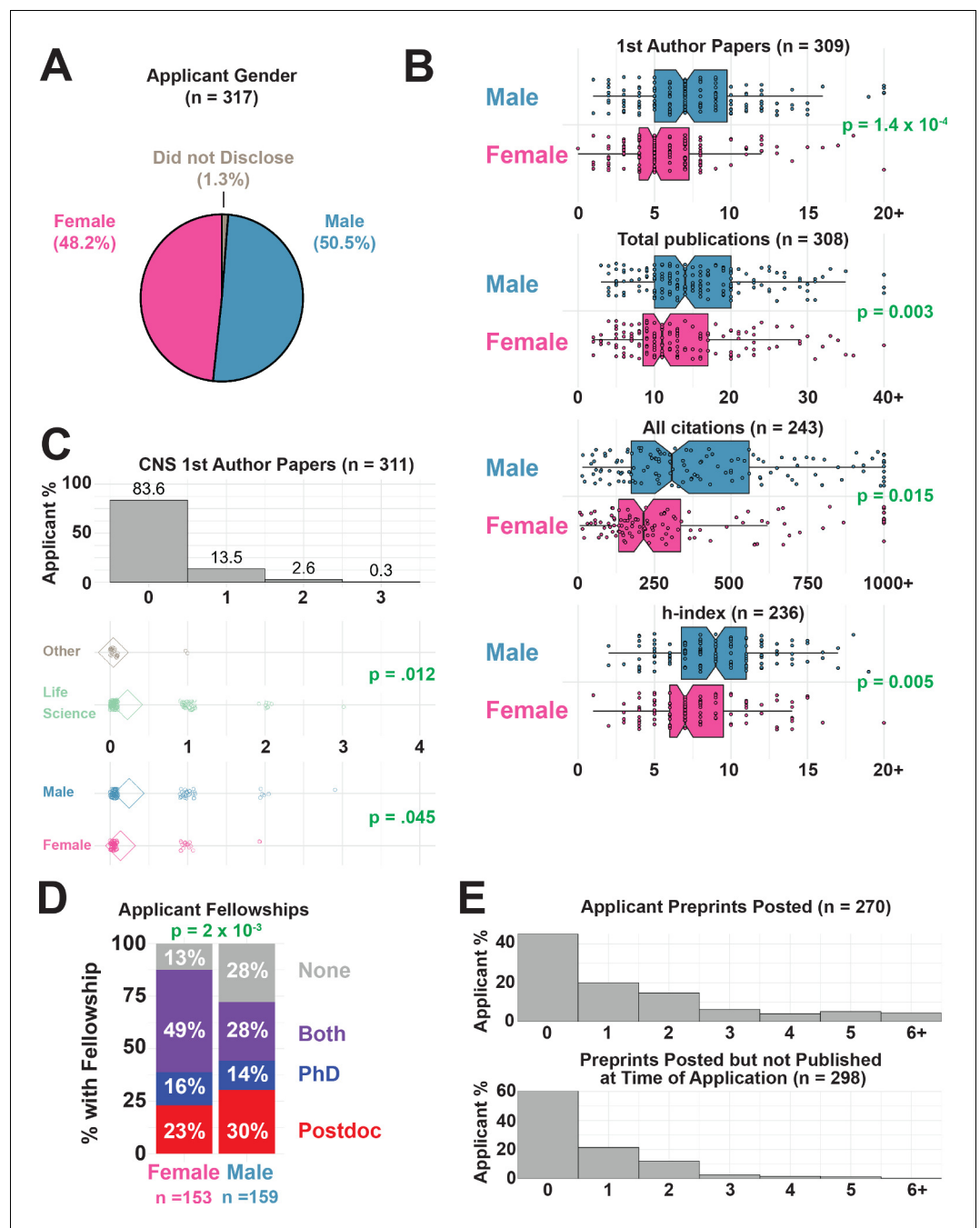


Figure 3. Applicant scholarly metrics by gender. (A) Distribution of gender (male, female, did not disclose) amongst survey respondents (*Supplementary file 2*, first row). (B) Publication metrics of survey respondents including number of first author papers (top), total publications (middle top), total citations (middle bottom), and h-index (bottom) for male and female respondents. Men in our survey reported more first-authored papers than women (medians of 7 and 5, respectively; $p=1.4 \times 10^{-4}$), more total publications (medians of 16 and 11; $p=3.0 \times 10^{-3}$), more overall citations (medians of 343 and 228; $p=1.5 \times 10^{-2}$), and a statistically significant higher h-index (medians of 9.0 and 7.0; $p=5.40 \times 10^{-3}$; see *Supplementary files 7* and *9*). (C) Although most applicants (83.6%) did not have first-author papers in CNS, those in the life sciences had more than applicants in other fields ($p=0.012$), and men had more than women ($p=0.45$; see *Supplementary files 7* and *11*). Note: CNS papers do not include papers in spin-off journals from Cell, Nature or Science. (D) Distribution of funding reported within training period (doctoral fellowship only in blue, postdoctoral fellowship only in red, fellowships during PhD and postdoc in purple, and no fellowship in gray). Females reported significantly more fellowship funding than males (42% of women vs 36% of men for predoctoral fellowships, and 72% of women, 58% of men for postdoctoral fellowships, *Figure 3 continued on next page*

Figure 3 continued

$p=2.40 \times 10^{-3}$, $\chi^2 = 12.10$, Chi-squared test, $df = 2$, see **Supplementary files 7 and 13**. (E) Preprints were posted by 148 of 270 (55%) individual candidates, with an average of 1.57 preprints reported per candidate (top). Number of preprints posted which were not yet accepted for journal publication (bottom) while applying for faculty jobs (see **Supplementary file 14**).

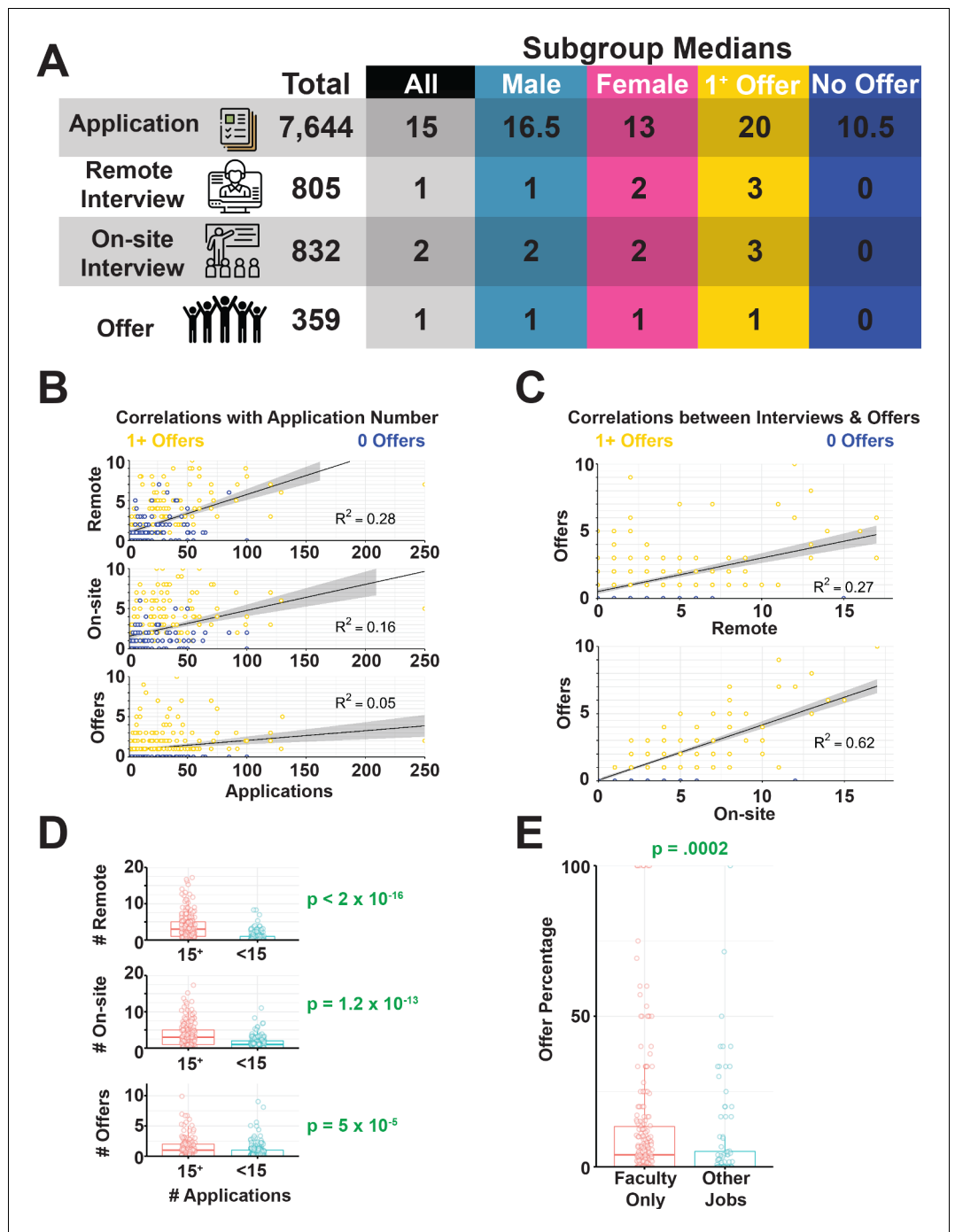


Figure 4. Job application benchmarks and their impact on success. (A) Total and median numbers of applications, off-site interviews, on-site interviews and offers recorded in survey responses (**Supplementary file 19**). (B) Correlations between the total number of applications submitted and off-site interviews (top; $R^2 = 0.28$), onsite interviews (middle) and offers (bottom; $R^2 = 4.77 \times 10^{-2}$). (C) Correlations between the number of interviews completed and offers received ($R^2 = 0.62$). See **Figure 4—figure supplement 1** for more details. (D) Total number of off-site interviews (top, $p < 4.10 \times 10^{-24}$, on-site interviews (middle, $p = 1.20 \times 10^{-13}$) and offers (bottom, $p = 5.0 \times 10^{-5}$) for applicants who submitted at least 15 (the median) applications (in red) and less than 15 applications (in blue). (E) Fraction of applications that resulted in offers (offer percentages) for survey respondents who did not apply for jobs outside of faculty positions is significantly higher ($p = 2.0 \times 10^{-3}$, **Supplementary file 7**) than for those who also applied for both academic and other types of jobs (**Supplementary file 14**).

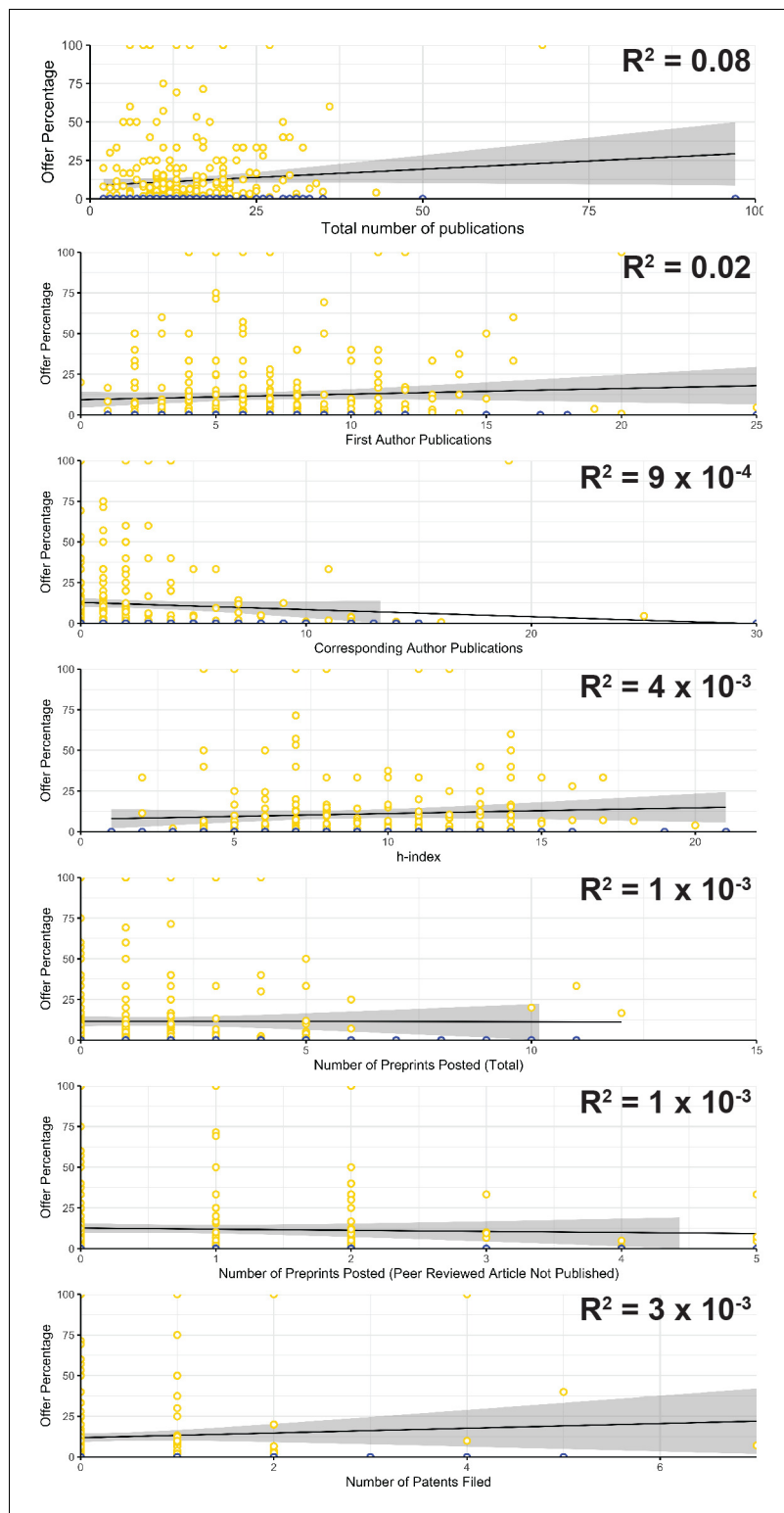


Figure 4—figure supplement 1. Correlations between offer percentage and a number of traditional scholarly metrics. Pearson correlation coefficient (R^2) between offer percentage total number of publications (top), number of first author publications (second graph), number of corresponding author publications (third graph), h-index (fourth graph), preprints posted (overall total, fifth graph; as well as those in which the peer-reviewed article was not published at the time of application, sixth graph), and number of patents filed, bottom graph). Yellow dots represent candidates with an offer, blue dots received no offers; black line represents linear best-fit and gray fill

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represents the 95% confidence interval for that fit. We examined several other publication metrics and found no correlation with the number of offers. Specifically, the total number of publications ($R^2 = 8 \times 10^{-2}$), the number of first author ($R^2 = 2 \times 10^{-2}$), the number of corresponding author publications ($R^2 = 9 \times 10^{-4}$), and h-index ($R^2 = 4 \times 10^{-3}$) did not significantly correlate with offer percentage.

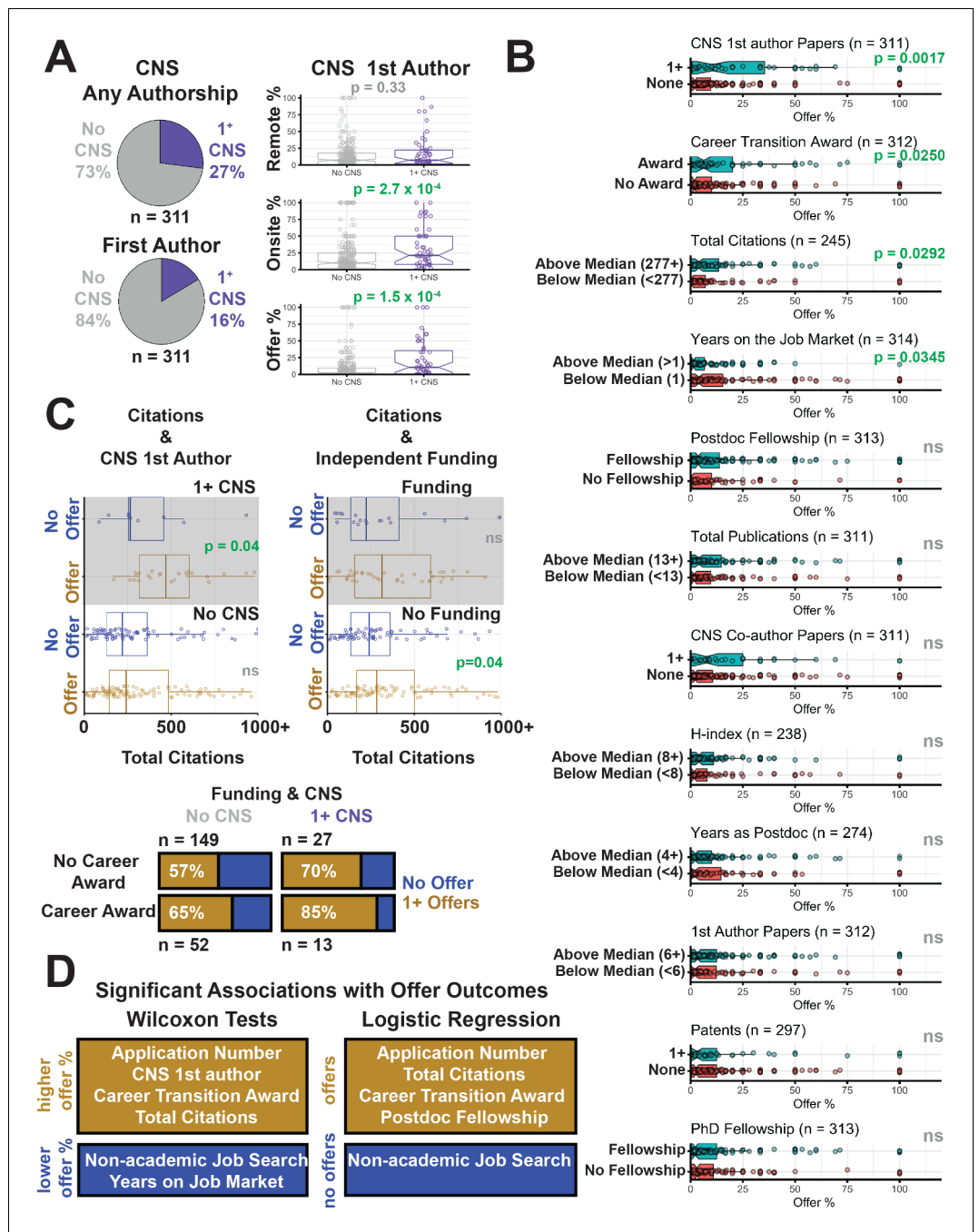


Figure 5. Traditional research track record metrics slightly impact job search success. (A) Pie charts show the fraction of candidates with authorship of any kind on a CNS paper (purple) versus those without (gray), and fraction of candidates who were first author on a CNS paper (purple) versus those who were not (gray). Distributions of off-site interviews (top; $p=0.33$), onsite interviews (middle; $p=2.70 \times 10^{-4}$) and offers (bottom; $p=1.50 \times 10^{-4}$) for applicants without a first-author paper in CNS (gray), and those with one or more first-author papers in CNS (purple; **Supplementary files 11, 12, 17**). (B) Significant associations were found between offer percentage and the number of first-author papers in CNS (top panel, $p=1.70 \times 10^{-3}$), career transition awards (second panel, $p=2.50 \times 10^{-2}$), total citations (third panel, $p=2.92 \times 10^{-2}$), and years on the job market (fourth panel, $p=3.45 \times 10^{-2}$). No significant associations were found between offer percentage and having a postdoc fellowship (fifth panel), being above the median in the total number of publications (sixth panel), being an author in any position on a CNS paper (seventh panel), h-index (eighth panel), years as a postdoc (ninth panel), number of first-author papers (tenth panel), number of patents (eleventh panel), or graduate school fellowship status (twelfth panel). *Figure 5 continued on next page*

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panel; **Supplementary files 6, 7, 9, 10, 11, 12, 13** and **21**). (C) The plots show total citations for those without an offer (blue) and those with one or more offers (gold), for all applicants with one or more first-author papers in CNS (top left); for all applicants without a first-author paper on CNS (bottom left); for all applicants with independent funding (top right); and for all applicants without independent funding (bottom right). In two cases the p value is below 0.05. The bar charts show the offer percentages (gold) for the four possible combinations of career award (yes or no) and first-author paper in CNS (yes or no): for applicants with a first-author paper in CNS, $p=0.56$, $\chi^2 = 0.34$; for applications without, $p=0.17$, $\chi^2 = 1.92$). (D) Summary of significant results testing criteria associated with offer outcomes through Wilcoxon analyses (**Supplementary file 7**) or logistic regression (**Supplementary file 24**).

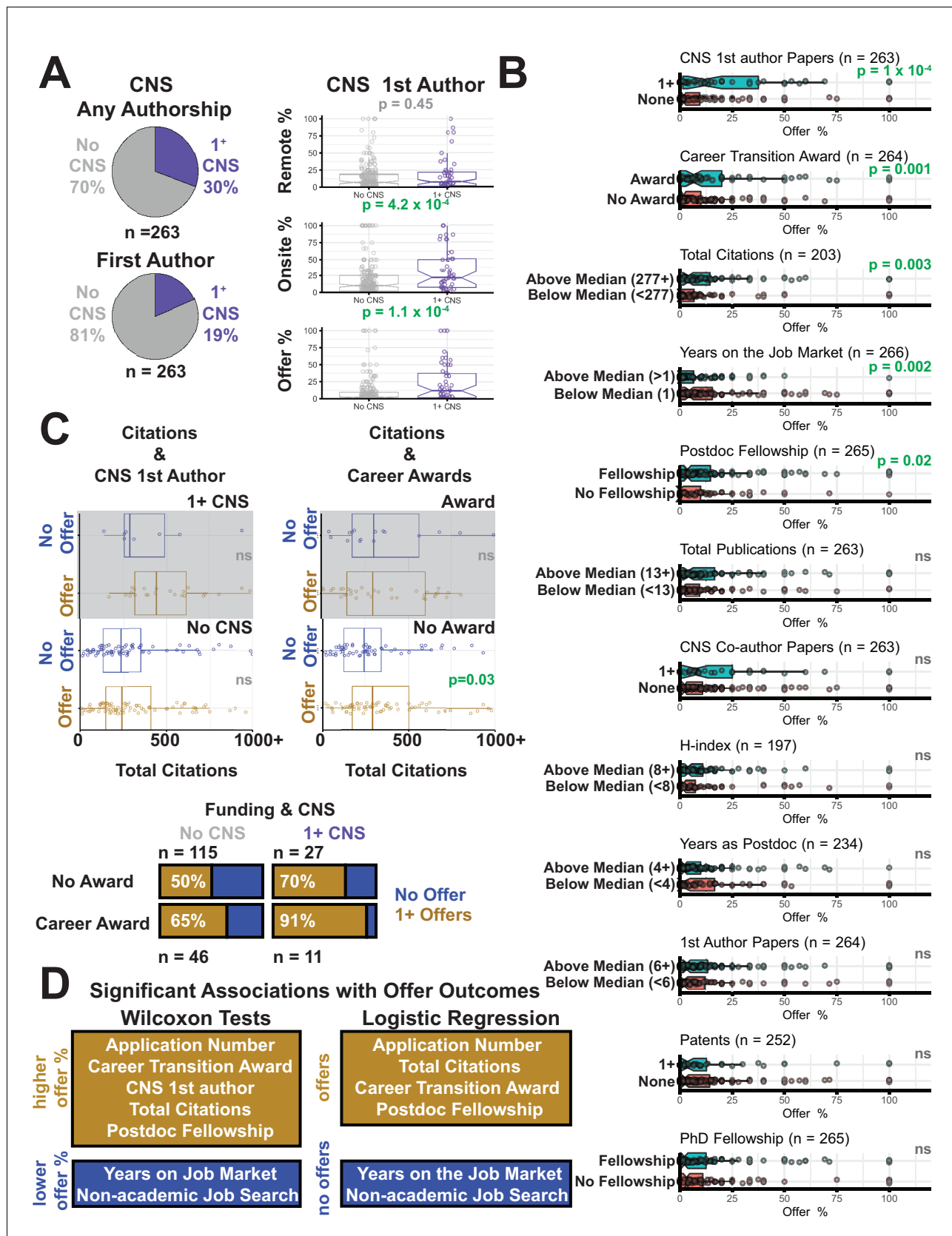


Figure 5—figure supplement 1. Life-science specific analysis of applicant survey outcomes. We performed identical analysis as in **Figure 5** but restricted to applicants (n = 269) who described their field as life-science related (as defined in **Figure 2**).

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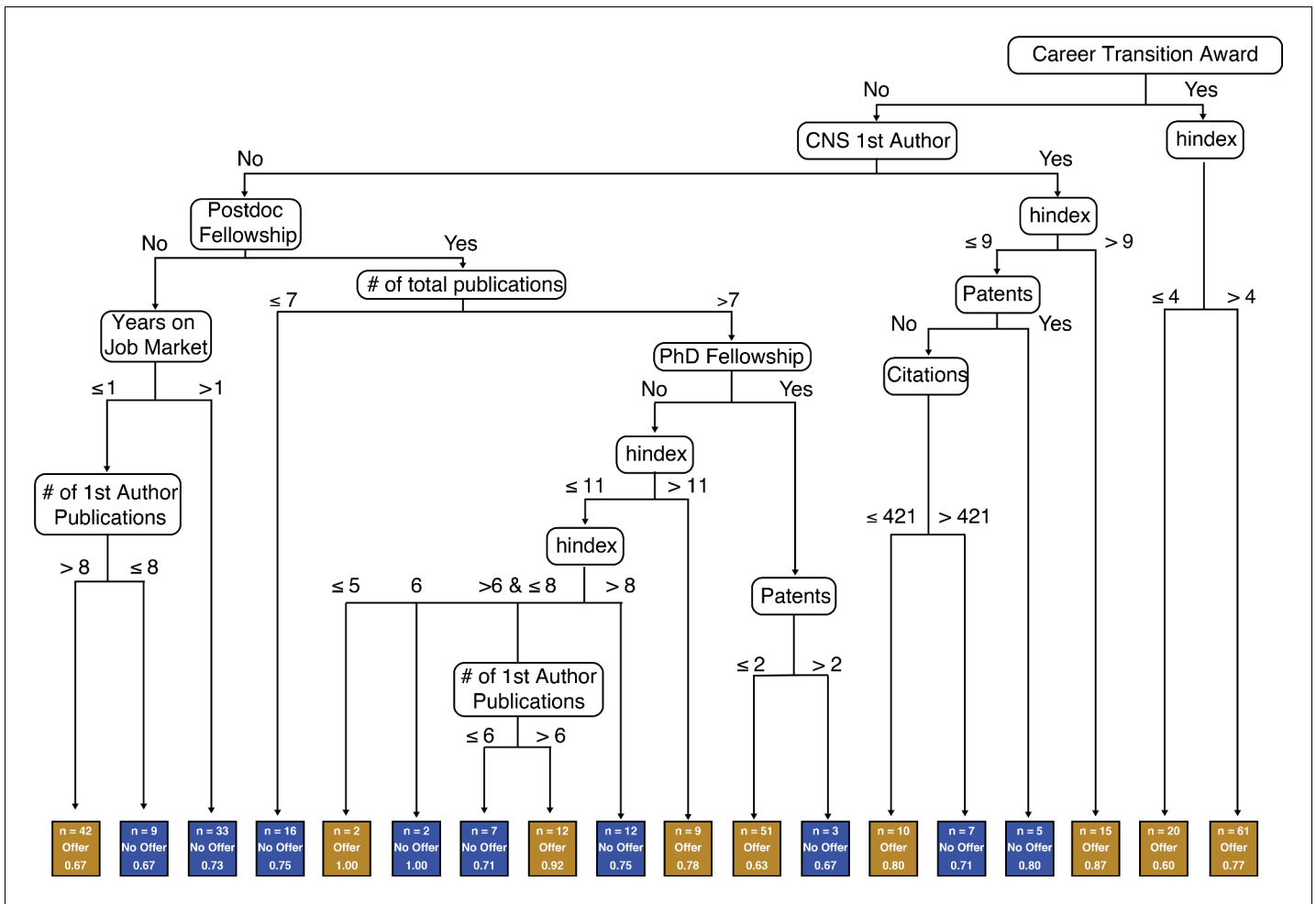


Figure 5—figure supplement 2. Visualization of possible paths to an offer using the C5.0 decision tree algorithm. Each rounded node represents an independent variable and each rectangular node represents one of two possible outcomes (offer (gold) or no offer (blue)). Only those variables in **Figure 5B** were included. In the case of binary variables such as funding and fellowships, ">0" indicates a "yes" and " ≤ 0 " indicates a "no". All other variables, except for h-index, were split based on counts. The outcome nodes are labeled with three pieces of information: (Cyranoski et al., 2011) the number of applicants who fell into the given branch (n), (Ghaffarzadegan et al., 2015) the most common outcome in that branch, and (Schillebeeckx et al., 2013) the fraction of individuals with that outcome. For example, the rightmost branch shows applicants who had a career transition award and h-index >4. They constitute the largest group in our dataset (61 individuals). However, only 77% of these applicants received an offer. Similarly, the second and third largest groups included 51 applicants (63% with offer) and 42 applicants (67% with offer) respectively (see eighth outcome box from right and leftmost box). These three groups accounted for 48.6% of our survey respondents. Note that while decision trees have often been used as prediction models, this tree is only reflective of our dataset and choice of algorithm and parameters. We have used this solely for visualization purposes and advise against using this prospectively to evaluate chances of success on the job market as there may be alternative trees that are equally plausible and accurate. In fact, the accuracy of the overall decision tree in distinguishing between candidates with offers and those without was only 58.5%. Furthermore, no group with more than two applicants consisted purely of those with offers and those without. Even in the nine groups where the most common outcome was "no offer", on average, 25% of the applicants did receive offers.

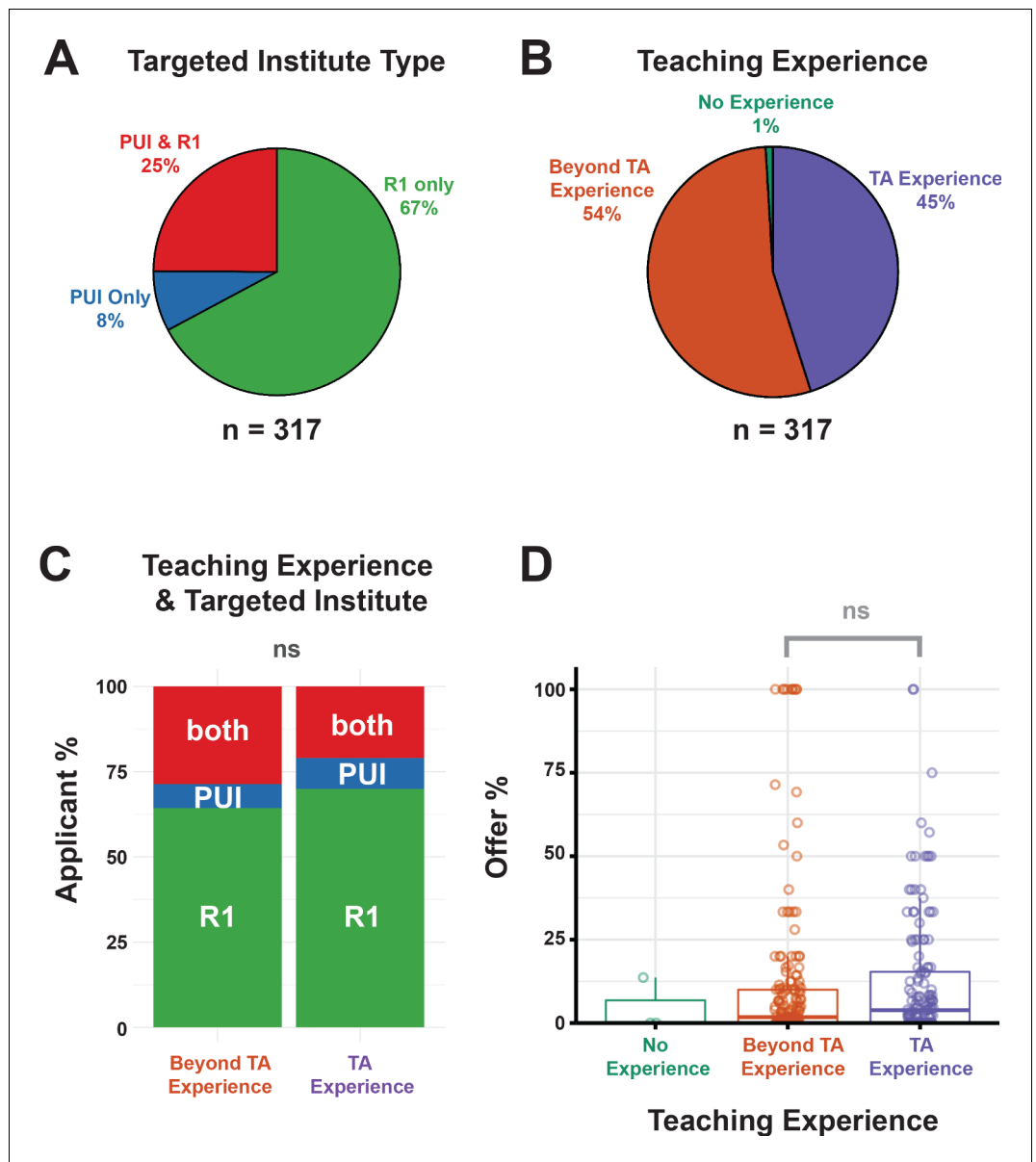


Figure 6. Summary of applicant teaching experience and impact on job search success. (A) Distribution of institution types targeted by survey applicants for faculty positions (PUI only in blue, R1 institutions only in green, or both in red, *Supplementary file 26*). (B) Distribution of teaching experience reported by applicants as having TA only experience (in purple), beyond TA experience (e.g. teaching certificate, undergraduate and/or graduate course instructorship, guest lectureship and college adjunct teaching, (in orange), or no teaching credentials (in green; *Supplementary files 27* and *28*). (C) Distribution of teaching experience (TA experience, right, vs. Beyond TA experience, left) for applicants who applied to R1 institutions only (in green), PU institutions only (blue), or both R1 and PUIs (in red), (*Supplementary file 27*). The degree of teaching experience did not change based on the target institution of the applicant ($p=0.56$ (ns), $\chi^2 = 0.41$; Chi-squared test). (D) Association between offer percentage and teaching experience is not significant ($p=0.16$; *Supplementary files 7, 27* and *28*).

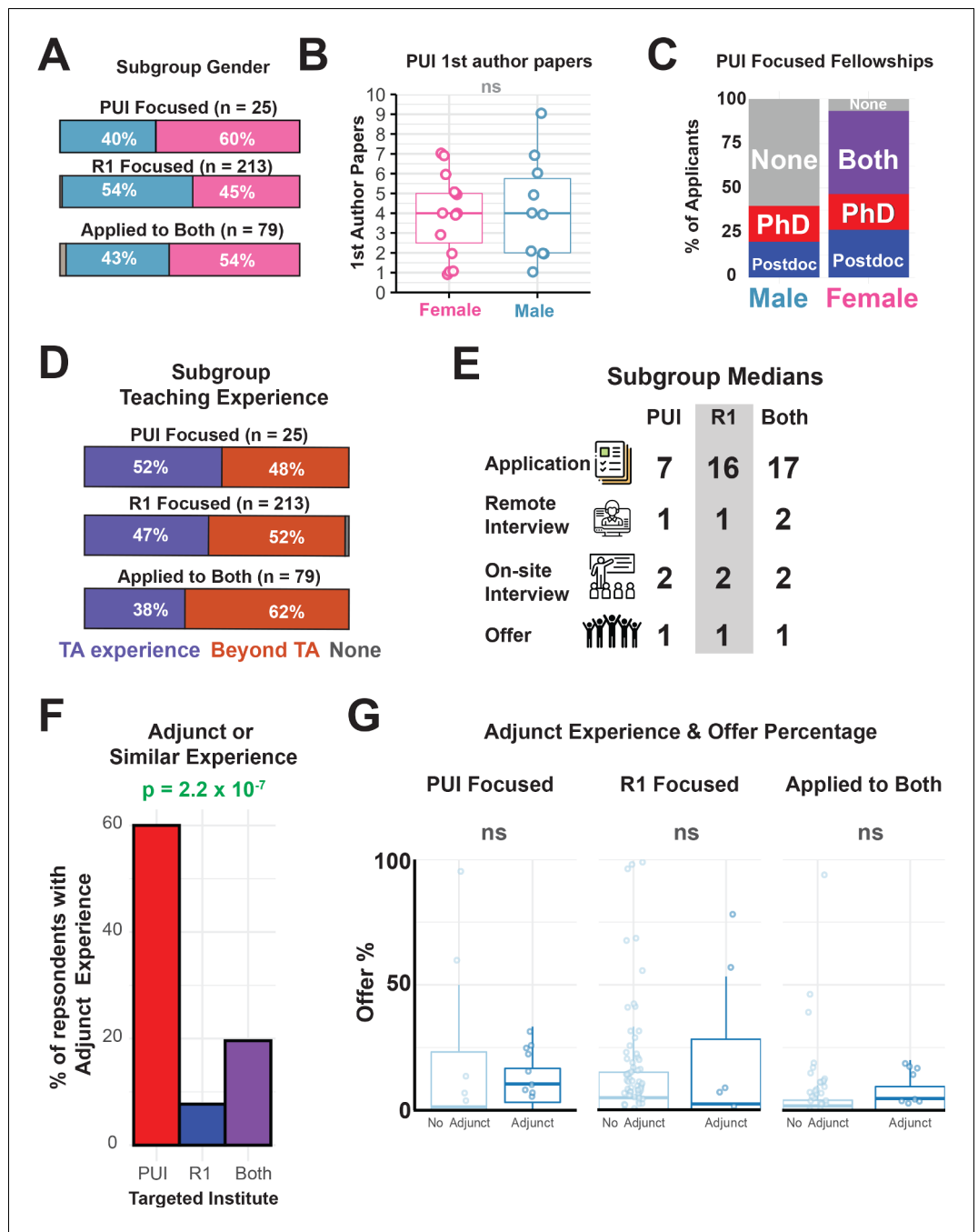


Figure 7. PUI focused applicants differ only in teaching experience from the rest of the application pool. (A) The gender distribution applicants who focused on applying to PUIs (**Supplementary file 26**). (B) The gender distribution and number of first-author publications of the applicant who focused on applying to PUIs ($p=0.88$). (C) Summary of the fellowship history by gender for PUI focused applicants (**Supplementary file 13**). (D) Distribution of teaching experience of PUI focused applicants (**Supplementary file 27**). (E) The median number of applications, off-site interviews, on-site interviews and offers for PUI focused applicants. (F) Percentage of survey respondents who identified having "adjunct teaching" experience (**Figure 1**) based on target institution ($p=5.0 \times 10^{-4}$; $\chi^2 = 27.5$, Chi-squared test). (G) The number of offers received segregated by "adjunct teaching" experience in either PUI focused applicants ($p=0.55$) or R1/both R1 and PUI focused applicants ($p=0.98$).

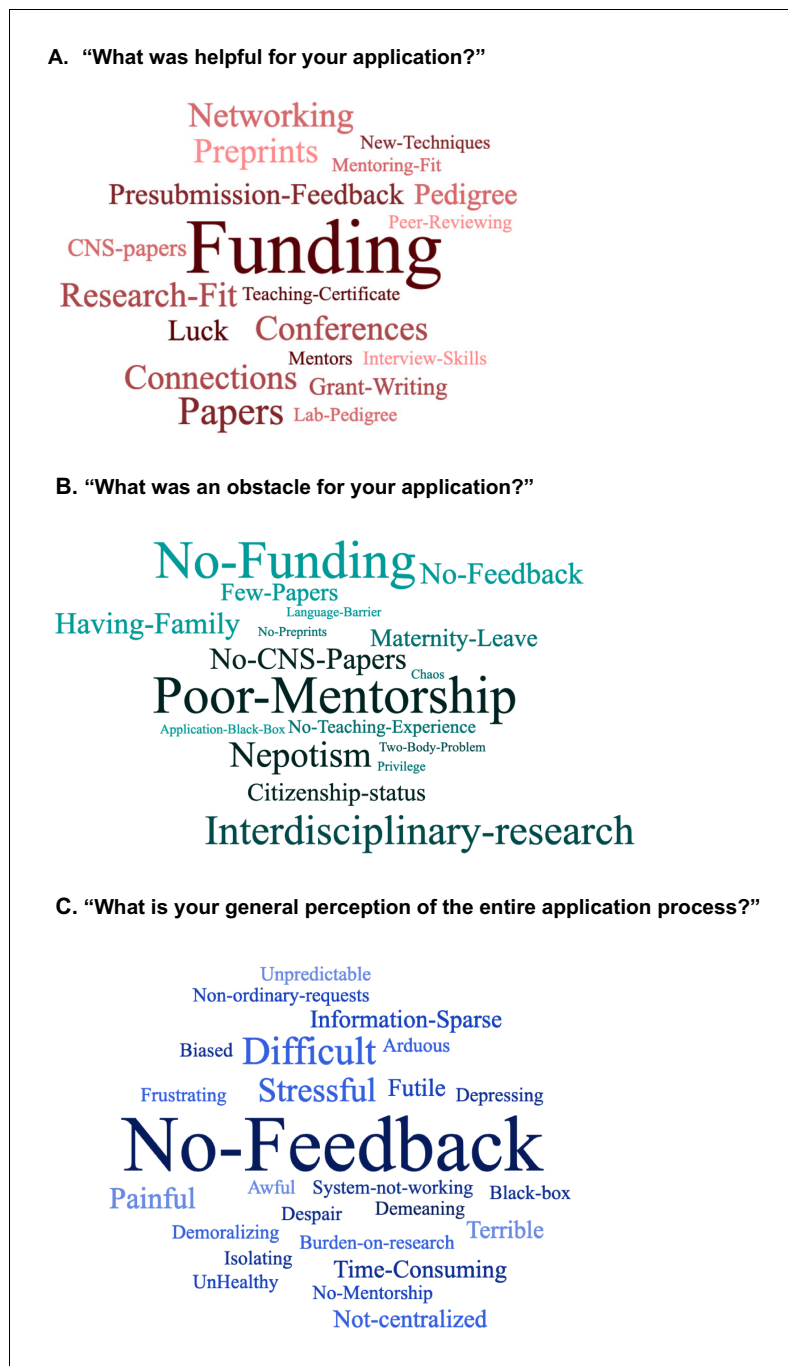


Figure 8. Perceptions of the job application process. Three word clouds summarizing qualitative responses from the job applicant survey respondents to the following questions: **A)** "What was helpful for your application?" (top; **Supplementary file 17**), **(B)** "What was an obstacle for your application?" (middle; **Supplementary file 18**), and **(C)** "What is your general perception of the entire application process?" (bottom; **Supplementary file 31**). The size of the word (or short phrase) reflects its frequency in responses (bigger word corresponds to more frequency). Survey respondents were able to provide longer answers to these questions, as shown in **Supplementary files 17, 18** and **31**. 'CNS-papers' refers to papers in Cell, Nature or Science; 'Pedigree' refers to the applicant's postdoc lab pedigree or postdoc university pedigree; 'Grant-Writing' refers to the applicant's grant writing experience with their PhD or postdoctoral mentor; 'Peer-reviewing' refers to the experience of performing peer-reviewing for journals; 'Interdisciplinary-research' refers to comments stating that Interdisciplinary research was underappreciated; 'two-body problem' refers to the challenges that life-partners face when seeking employment

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in the same vicinity; 'No-Feedback' refers to lack of any feedback from the search committees on the status, quality or outcome of applications.

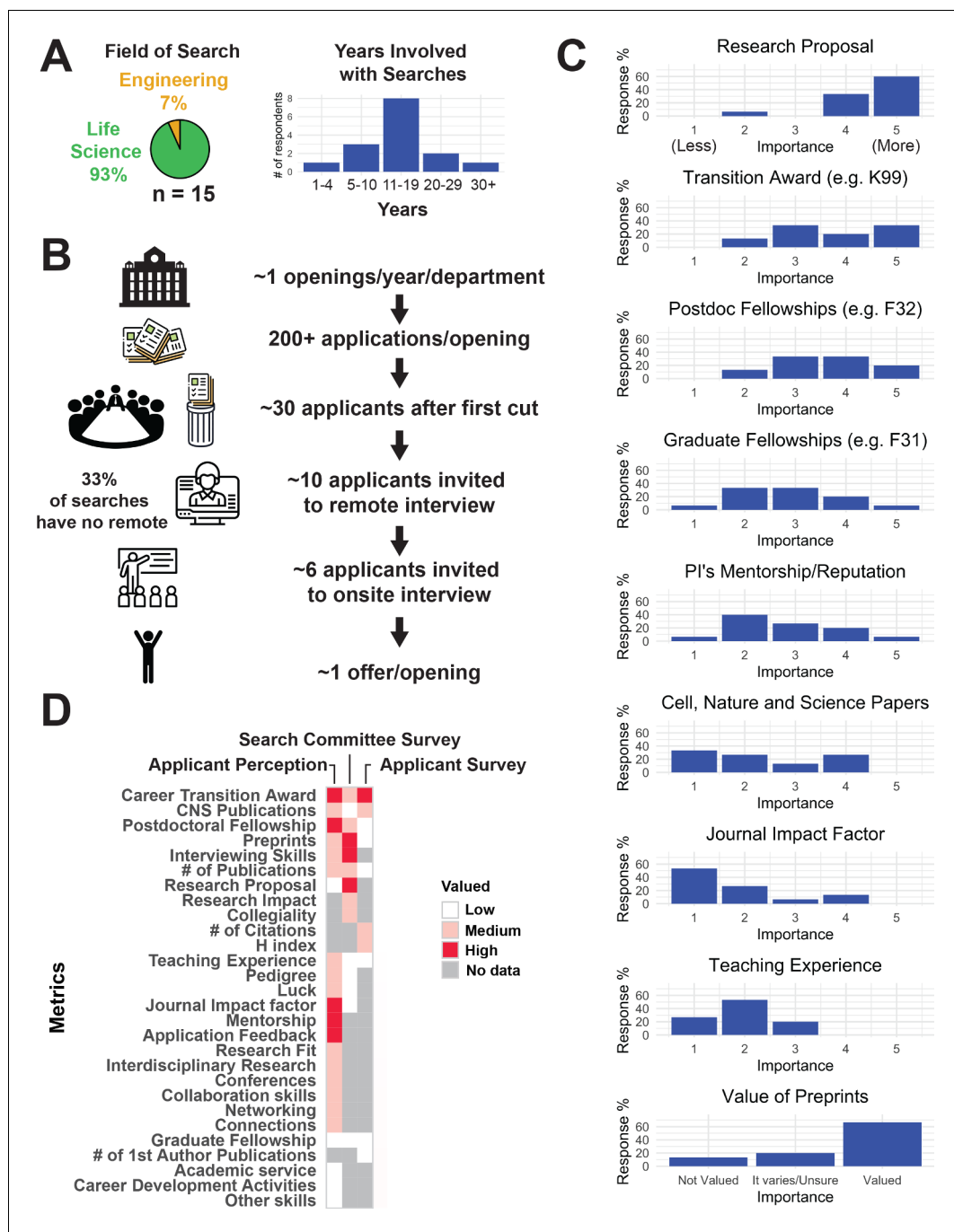


Figure 9. Summary of metrics valued by search committees. Search committee members were asked on how specific factors were weighted in the decision on which applicant to extend an offer to (**Supplementary files 33–38**). All search committee members surveyed were based at R1 universities (**Box 1**). (A) Distribution of the fields of study and years of experience for the search committee survey respondents. (B) The median number of faculty job openings, number of applicants per opening, applicants that make the first cut, applicants who are invited for phone/Skype interviews, and offers made. (C) The quantitative rating of search committee faculty on metrics: candidate/applicant research proposal, career transition awards, postdoctoral fellowships, graduate fellowships, PI/mentor reputation (lab pedigree), Cell/Nature/Science journal publications, Impact factor of other journal publications, Teaching experience and value of preprints based on a 5-level Likert scale where 1 = not at all and 5 = heavily. (D) Visual summary of the job applicant perception (from word cloud data) and the results of both surveys (statistical analyses of the applicant survey and criteria weighting from the search committee survey). A *Figure 9 continued on next page*

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number of metrics mentioned in short answer responses were not measured/surveyed across all categories. These missing values are shown in gray.

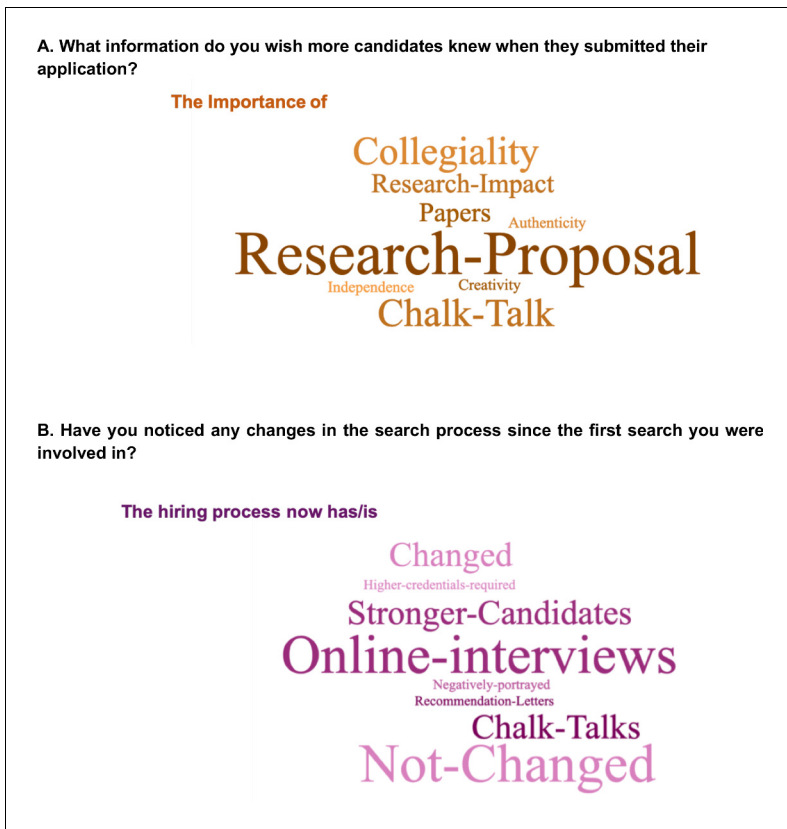


Figure 10. Search committee perception of the faculty job application process. Two word clouds representing responses from members of search committees in response to the following questions: A) "What information do you wish more candidates knew when they submit their application?", and B) "Have you noticed any changes in the search process since the first search you were involved in?" The size of the word/phrase reflects its frequency in responses, with larger phrases corresponding to more frequent responses. Search committee faculty members were able to provide long answers to both questions (*Supplementary files 38* and *39*).

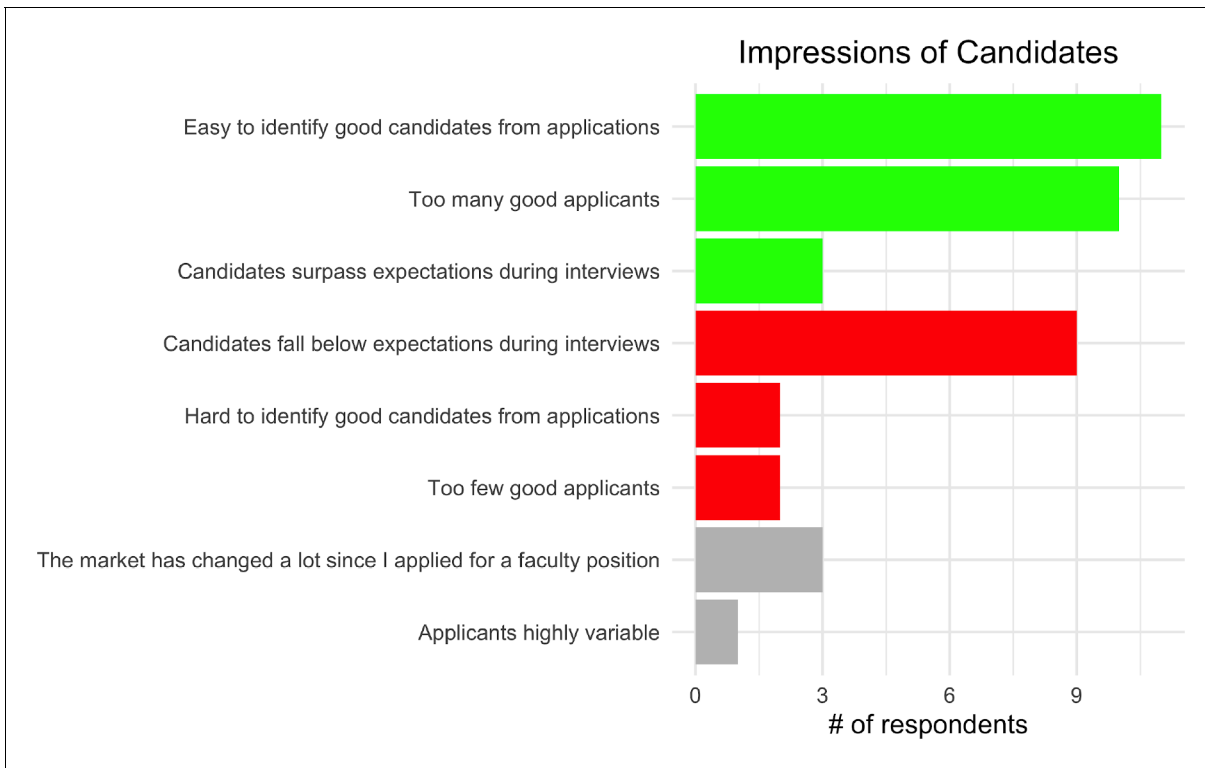


Figure 10—figure supplement 1. Overview of search committee impressions of the candidates. Bar chart showing the number of search committee respondents who held each of the opinions shown for candidates applying to academic jobs that they had been in the search committees for (*Supplementary file 36*). Additional files.