

Assessment of gender differences in letters of recommendation for pharmacy residency applicants

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Purpose. Letters of recommendation (LORs) are highly regarded components of pharmacy residency applications, as they provide insight into an applicant's character and capabilities. In other medical fields, differences in language have been reported for letters written for female and male applicants; however, data on gender differences in LORs for pharmacy residency applications are currently lacking.

Methods. LORs for applicants to our institution's postgraduate year 1 pharmacy residency program for the 2019-2020 academic year were extracted and processed by a natural language processing service. Words within 18 categories were identified and counted for each LOR. Total was also compared.

Results. Of the 473 LORs included for analysis, 320 (67.7%) were written for female applicants and 153 (32.3%) were written for male applicants. Approximately two-thirds of all writers were women for both female and male applicants. In comparing letters for women and men, there was a statistically significant difference in the percentage of LORs that contained terms in categories described as gendered, solitary/reserved, and desire. There was no statistically significant difference in total or in the presence of words in other categories such as grindstone, standout, agentic, or communal. When controlling for grade point average, writer gender, duration that the writer knew the applicant, and the writer's professional position, there were no changes to the statistical findings.

Conclusion. Letters written for female and male applicants were largely similar with regard to length and word categories utilized. While no clear gender bias was found when evaluating pharmacy residency LORs, writers must continue to assess their implicit biases and how those biases might affect a candidate's application.

Keywords: gender bias, implicit bias, job application, letters of recommendation, pharmacy residencies

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Letters of recommendation (LORs) have been identified as one of the most highly regarded components of pharmacy residency applications.^{1,2} However, little has been published on how LORs impact candidacy since the format changed in 2013 from a single narrative letter. Currently, writers within the American Society of Health-System Pharmacists (ASHP) Pharmacy Online Residency Centralized Application System (PhORCAS) rank a candidate in 13 different character domains (Box 1) as “exceeds,” “appropriate,” “fails to meet,” or “N/A,” with an option to include up to 6,500 words explaining the selected ranking. Additional sections provide an opportunity to describe the relationship between the letter writer and the candidate, areas of strength for the candidate, areas for improvement for the candidate, any other characteristics not already described, and any specific comments as they relate to the program to which the candidate is applying. Finally, PhORCAS requires selection of an overall recommendation. Options for this include “highly recommend,” “recommend,” “recommend with reservation,” and “do not recommend.” In reviewing nearly 6,000 PhORCAS LORs submitted from 2015 through 2018, Atyia and colleagues³ found that the categorical ratings correlated poorly with application score and outcome. This demonstrates that the actual verbiage within an LOR may hold greater importance than the categorical ranking data. A study by McLaughlin and colleagues⁴ analyzed LOR verbiage to assess characteristics associated with offering an interview. They reported that reference to gender (eg, “he” or “she”) within a letter did not impact the likelihood of the candidate receiving an interview offer. “Standout words” such as excellent and superb, as well as references to teaching, increased the likelihood of an offer to interview. However, the authors did not specifically assess verbiage differences between applicants of different gender.

The amount of literature on LORs in medical and academic settings highlighting linguistic differences between letters written for female and male applicants is growing. These studies often compared and use of specific types of word categories between LORs for women and men. Common types of word categories in addition to standout words include grindstone words (eg, committed or hardworking), agentic character descriptions (eg, dominant or independent), and communal words (eg, affectionate or respectful).⁵⁻⁹ This research assessing differences between letters written for women and men is important because the use of various word types can result in implicit biases influencing the selection of candidates.⁵ Given the dearth of published information about LORs for pharmacy residency applicants and verbiage differences that may exist between letters written for women and men, a retrospective study was undertaken. The primary objective of our study was to assess differences in length and word category use between letters written for female and male applicants.

Methods

This study was deemed exempt by the institutional review board and reviewed by the Mayo Clinic School of Health Sciences (MCSHS). Each LOR from PhORCAS applications for the postgraduate year 1 (PGY1) pharmacy residency program for the 2019-2020 academic year was extracted to an individual text document. This allowed for editing to remove headers containing the applicant's full name for deidentification purposes. Letters were screened to replace the applicant's last name with "X" throughout each LOR, to preserve . Extraneous information within the LOR, including salutations, closings, and the writer's name, academic rank, title, and affiliation, was removed because such elements

were not consistent in all letters and often contributed significantly to . LORs for candidates who matched with the PGY1 pharmacy residency program for the 2019-2020 academic year were excluded ($n = 5$) as required by the MCSHS for confidentiality purposes.

Extracted letters were sent to the Natural Language Processing (NLP) service. The NLP service provides a customizable approach to processing unstructured text to find terms or concepts of interest and increase efficiency over manual assessment. Words to be extracted were based on and adapted from previous research by French and colleagues¹⁰ using a word dictionary with permission. This database contained 18 unique categories (Figure 1). Apache Tika (Apache Software Foundation, Forest Hill, MD) was used to convert Word documents (Microsoft Corporation, Redmond, WA) into raw string format. Using the word database, regular expressions were implemented to find specific words and total in each LOR.

It was estimated that approximately 400 LORs would be needed to provide 80% power with the ability to detect a 15% difference between specific word categories and the total of letters written for female and male applicants. The gender of the applicants was determined by assessing the pronouns used by the letter writers. Comparisons between applicant genders were made using generalized estimating equations with an unstructured correlation structure to take into account the fact that each applicant had multiple letters written for them and similar characteristics/words might be used for them in these letters. Multivariable generalized estimating equations were used to adjust associations between applicant gender and characteristics/words by grade point average (GPA), the writer's gender, the duration of the writer-applicant relationship, and the writer's position (employer, faculty, and/or preceptor). All tests were 2-sided, and P values equal to or less

than 0.05 were considered statistically significant. All analyses were performed using SAS version 9.4 software (SAS Institute Inc, Cary, NC).

Results

In total, there were 473 LORs written that were included for analysis. Of these, 320 (67.7%) letters were written for female applicants and 153 (32.3%) letters were written for male applicants. There were no differences in the percentages of female vs male LOR writers, mean GPA, duration that the LOR writer knew the applicant, and the disclosed position of the LOR writer between female and male applicants (Table 1).

The lengths of the letters did not significantly differ between female and male applicants (mean [SD], 859 [463.9] words vs 822.4 [434.8] words; $P = 0.43$). The range for female and male applicants was 94 to 3,323 words and 54 to 2,519 words, respectively. Of the letters reviewed, 106 (22.4%) had fewer than 500 words. Of these shorter letters, 58.5% were written for female applicants and 41.5% were written for male applicants. There was no difference in the percentage of letters with fewer than 500 words between female and male applicants (21.6% vs 24.2%, $P = 0.54$) or in female and male letter writers (21.1% vs 24.6%, $P = 0.40$).

In comparing female and male applicants, there was a statistically significant difference in the percentage of LORs that contained terms in categories described as gendered, solitary/reserved, and desire. There was no statistically significant difference in the presence of words in other categories such as grindstone, standout, social, agentic, communal, or hedgers (Table 2). Upon investigation of individual words, several were

statistically different between female and male applicants, including commitment, competent, diligent, dress, independent, outstanding, responsive, unique, and wonderful (where * represents wild card text; Table 3). When controlling for GPA, the writer's gender, the duration of the writer-applicant relationship, and the writer's professional position, amazing and curious were statistically different between female and male applicants, but outstanding and wonderful were no longer statistically different.

Discussion

Our interest in completing this work derives from the paucity of literature on gender equity, diversity, and inclusion in the postgraduate pharmacy training literature. Relatively few differences were identified between letters written for female and male applicants. Specifically, usage of words in categories often investigated in studies of other professions, including agentic, grindstone, standout, and communal terms, did not differ in whether they were used at all. These findings correlate with several studies conducted in fields including emergency medicine and surgery, which found no significant difference in the majority of word categories.^{10,11} The use of communal words and agentic words to describe female and male applicants has been evaluated extensively. A 2009 investigation conducted by Madera and colleagues⁵ in an academic setting found that, when applying for faculty positions in a psychology department, men were more often described with agentic words while women were more often described with communal words. In their discussion, the authors question whether this represents a true difference in behavior or rather the writers' perception as affected by social role stereotyping. Existing stereotypes and stigma may cause writers to feel more comfortable describing women with communal characteristics. However, the

authors also found that communal characteristics were negatively related to hireability, emphasizing concern for the real-world effects of gender bias in LORs. Hoffman and colleagues⁹ identified similar differences in the use of agentic and communal terms for transplant surgery applicants; however, Grimm and colleagues¹² found that agentic words were used more frequently in LORs for female applicants. Clear variation exists in the use of these specific word categories to describe women and men in different medical fields. Importantly, the characteristics and terms that are most desired in applicants will also vary based on the profession or field. Communal characteristics, which include being concerned with the welfare of others, may be of greater value in a pharmacy residency application and a characteristic that application reviewers seek. Further research is warranted to assess the differing effects of the language used in LORs on hiring in various professions.

In our study, there were several differences between LORs written for female and male applicants. Of the word categories that statistically differed, solitary/reserved and desire terms occurred more frequently in LORs for female applicants. Describing an applicant with solitary/reserved words without commenting on the applicant's ability to overcome reservations has the potential to negatively impact the overall impression of the application.

The individual terms that were found more often in LORs for women in our study were amazing (after adjustment), independ\S*, outstanding (no longer significant after adjustment), respons\S*, unique, and wonderful. Three of these 6 are standout words; however, there was no statistically significant difference in the use of any standout word overall between letters written for women and men. Individual terms that occurred more frequently in the LORs of men included commitment, competent, curio\S*, diligen\S*, and

dress\S*, of which 2 are grindstone words. In other healthcare professions, use of standout words and grindstone words has been associated with men and women, respectively. Turrentine and colleagues⁷ found that male applicants for surgical residency were more likely to be described with standout words, while female applicants were more likely to be described with grindstone words. The authors explored how standout and grindstone words relate to existing gender schemas through which men may be more highly regarded for their achievement and women may be more highly regarded for their hard work and nurturing behaviors. It is encouraging that we did not note a statistically significant difference in the use of standout or grindstone words overall, demonstrating a balance in word use for female and male applicants for pharmacy residency. Although after an analysis of individual words, few were found to differ between the LORs of women and men, letter writers should seek to overcome inherent gender biases by utilizing a variety of words from different word categories in letters for female and male applicants. More importantly, writers should provide specific examples that corroborate the terms utilized for each applicant. This practice will strengthen the letter overall while minimizing use of words based solely on existing gender schemas.

Most investigations presented for comparison, with the exception of those by Miller et al¹¹ and Li et al⁶, assessed traditional narrative LORs, which starkly contrast with the standardized scoring system used for pharmacy residency applications. A study conducted by Friedman and colleagues¹³ found that standardized LORs for head and neck surgery residency positions reduced gender biases compared to narrative LORs. This may, in part, explain why there were relatively few differences noted between female and male applicants in our study with the standardized PhORCAS form.

A recent survey of pharmacy residency applicants who participated in the 2016, 2017, or 2018 ASHP Residency Matching Program found that 73.2% of surveyed applicants were women.¹⁴ This is similar to our applicant pool, which included more women than men. The percentages of female and male letter writers were similar for all pharmacy residency applicants, with female writers representing the majority of authors. Thus, this is a consideration when understanding the lack of difference between the LORs of female and male pharmacy applicants. Also, this aligns with current ratios of women to men reported in the profession and among recent pharmacy school graduates.¹⁵ It is, however, starkly different from the writer composition in other healthcare fields, which range from 4% female writers for urology residency LORs to 25% female writers for radiology residency LORs.^{8,9} Similar studies in other medical professions have also reported that the majority of applicants and writers were men.^{7,10,12}

Our study assessed letters written for applications to a PGY1 program at the Mayo Clinic, a single academic medical center. This may limit the external validity of our findings, especially for postgraduate year 2 (PGY2) programs or programs in ambulatory care or community hospital settings. Additional limitations of this investigation include various assumptions on gender. First, pronouns used by LOR writers were utilized to determine the gender of applicants. Second, writer gender was determined based on information such as employers' websites and biographies posted on university websites when possible. The National Provider Identifier Registry, which includes the gender of individuals, was also used. For both applicants and letter writers, we made the assumption of binary pronouns. We were unable to account for differences in gender identity that were not evident based on available information. Third, the presence of negative qualifiers (eg, not responsible,

never open minded) and the greater context in which words were utilized within letters were not considered in the analysis. For example, as in previous publications, standout words were assumed to be positive.⁴ Finally, the MCSHS, which oversees guidelines for academic research at our institution, required that we exclude letters written for candidates who matched with our PGY1 program from our sample. As these may have been likely to be well-written, detailed letters, excluding them may have introduced bias in our results.

Given the increase in competitiveness among pharmacy residency applicants, LORs provide selection committees with crucial insight into the character of an individual, allowing for a more thorough assessment of top prospects. A complete review of appropriate LOR writing is beyond the scope of this paper, but, in general, writers must be prepared to provide a favorable letter. It is possible that the language used by a letter writer intending to write a favorable letter may be incorrectly interpreted by a selection committee when implicit biases are evoked. Thus, it is the duty of the writer to craft thoughtful letters that are specific to the applicant and free of misleading language. Inappropriate language in LORs will detract from a candidate's ability to obtain an interview and may have a lasting negative impact on the individual's career.

Our aim was to examine LORs written for pharmacy residency applicants to provide insight to future letter writers. While there were not large differences between letters for female and male applicants within this limited dataset, several additional pieces of information were garnered in the review that are of importance to future letter writers. First, while compiling LORs for the NLP service, we identified several letters that commented on race, nationality, or an applicant's accent. This should not occur within any LOR and may result in negative consequences for both the applicant and the letter writer. Second, there

were several letters reviewed that contained negative general comments about the applicant. In a review of these individual letters, negative comments were not always indicative of a poor candidate and may instead be a reflection of the writer. We speculate that this may occur, in part, because writers believe they must provide some comment in every category within the PhORCAS application, which is not generally expected. Finally, some letters assessed were as short as 54 words, which is hardly sufficient to provide any additional detail on an applicant and certainly not sufficient to provide the insight desired by selection committees. Altogether, we suggest that there is a need for increased educational resources on writing LORs, as it may not be a component of one's formal pharmacy education or training. These resources should also bring awareness to important concepts of diversity, equity, and inclusion.

Conclusion

Letters written for female and male applicants for a PGY1 pharmacy practice residency were largely similar with regard to length and word categories utilized; thus, it is unlikely that gender bias would significantly affect a candidate's application through their LORs. The effects associated with other facets of LORs for pharmacy residency, such as racial bias and contribution to specific portions of the standardized PhORCAS form, remain to be fully elucidated. This work should stimulate conversations and research on the topics of diversity, equity, inclusion, and implicit biases in pharmacy, including in pharmacy residency application processes.

Disclosures

The authors have declared no potential conflicts of interest.

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Figure 1. Example words from categories. Words and categories were derived from French et al¹⁰ with permission.

Key Points

- High-quality letters of recommendation are essential to the pharmacy residency selection process and can have a significant impact on an applicant's career trajectory.
- The results of this study indicate that letters written for female and male applicants were largely similar with regard to length and word categories utilized.
- Letter writers should be aware of potential gender biases and should actively seek to minimize implicit gender biases when writing letters for any pharmacy residency applicant.

Table 1. Demographics of Evaluated Sample of Residency Applicants

Characteristic	Female Applicants (n = 320)	Male Applicants (n = 153)	GEE P Value
Pharmacy GPA, mean (SD)	3.7 (0.3)	3.6 (0.3)	0.17
Writer gender, No. (%)			0.17
Female	192 (60.0)	102 (66.7)	
Male	128 (40.0)	51 (33.3)	
Duration of relationship, mean (SD), months	18.0 (22.6)	17.2 (15.8)	0.65
Employer ^a , No. (%)	48 (15.0)	26 (17.0)	0.53
Faculty ^a , No. (%)	112 (35.0)	54 (35.3)	0.95
Preceptor ^a , No. (%)	236 (73.8)	118 (77.1)	0.42

Abbreviations: GEE, generalized estimating equations; GPA, grade point average.

^aWriters could identify with more than one position type.

Accepted 14

Table 2. Results of Comparisons Between Letters of Recommendation for Female and Male Applicants

Category	Female Applicants (n = 320)	Male Applicants (n = 153)	Total (n = 473)	GEE P Value	Adjusted GEE P Value^a
Total				0.43	0.48
Mean (SD)	859.0 (463.9)	822.4 (434.8)	847.2 (454.5)		
Median (IQR)	773.0 (536.5- 1,078.5)	693.0 (517.0- 1,093.0)	762.0 (530.0- 1,082.0)		
Range	94-3,323	54-2,519	54-3,323		
Gendered terms ^b , No. (%)				0.007	0.001
No	313 (97.8)	141 (92.2)	454 (96.0)		
Yes	7 (2.2)	12 (7.8)	19 (4.0)		
Grindstone, No. (%)				0.36	0.37
No	3 (0.9)	3 (2.0)	6 (1.3)		
Yes	317 (99.1)	150 (98.0)	467 (98.7)		
Standout, No. (%)				0.22	0.26
No	11 (3.4)	9 (5.9)	20 (4.2)		
Yes	309 (96.6)	144 (94.1)	453 (95.8)		
Inventive curious, No. (%)				0.65	0.58
No	11 (3.4)	4 (2.6)	15 (3.2)		
Yes	309 (96.6)	149 (97.4)	458 (96.8)		
Consistent cautious, No. (%)				0.34	0.40
No	257 (80.3)	129 (84.3)	386 (81.6)		
Yes	63 (19.7)	24 (15.7)	87 (18.4)		
Efficient organized, No. (%)				0.77	0.39
No	30 (9.4)	13 (8.5)	43 (9.1)		

Category	Female Applicants (n = 320)	Male Applicants (n = 153)	Total (n = 473)	GEE P Value	Adjusted GEE P Value^a
Yes	290 (90.6)	140 (91.5)	430 (90.9)		
Easygoing careless, No. (%)				0.96	0.83
No	305 (95.3)	146 (95.4)	451 (95.3)		
Yes	15 (4.7)	7 (4.6)	22 (4.7)		
Outgoing energetic, No. (%)				0.90	0.77
No	136 (42.5)	66 (43.1)	202 (42.7)		
Yes	184 (57.5)	87 (56.9)	271 (57.3)		
Solitary/reserved ^b , No. (%)				0.045	0.046
No	42 (13.1)	32 (20.9)	74 (15.6)		
Yes	278 (86.9)	121 (79.1)	399 (84.4)		
Friendly compassionate, No. (%)				0.95	0.82
No	72 (22.5)	34 (22.2)	106 (22.4)		
Yes	248 (77.5)	119 (77.8)	367 (77.6)		
Sensitive nervous, No. (%)				0.65	0.79
No	285 (89.1)	134 (87.6)	419 (88.6)		
Yes	35 (10.9)	19 (12.4)	54 (11.4)		
Secure confident, No. (%)				0.16	0.17
No	15 (4.7)	12 (7.8)	27 (5.7)		
Yes	305 (95.3)	141 (92.2)	446 (94.3)		
Social, No. (%)				0.36	0.48
No	216 (67.5)	110 (71.9)	326 (68.9)		
Yes	104 (32.5)	43 (28.1)	147 (31.1)		
Agentic personality, No. (%)				0.28	0.20
No	10 (3.1)	8 (5.2)	18 (3.8)		
Yes	310 (96.9)	145 (94.8)	455 (96.2)		

Category	Female Applicants (<i>n</i> = 320)	Male Applicants (<i>n</i> = 153)	Total (<i>n</i> = 473)	GEE <i>P</i> Value	Adjusted GEE <i>P</i> Value ^a
Communal, No. (%)				0.60	0.63
No	16 (5.0)	6 (3.9)	22 (4.7)		
Yes	304 (95.0)	147 (96.1)	451 (95.3)		
Activities, No. (%)				0.47	0.27
No	36 (11.3)	14 (9.2)	50 (10.6)		
Yes	284 (88.8)	139 (90.8)	423 (89.4)		
Desire ^b , No. (%)				0.024	0.036
No	227 (70.9)	123 (80.4)	350 (74.0)		
Yes	93 (29.1)	30 (19.6)	123 (26.0)		
Hedgers, No. (%)				0.43	0.34
No	5 (1.6)	4 (2.6)	9 (1.9)		
Yes	315 (98.4)	149 (97.4)	464 (98.1)		

Abbreviations: GEE, generalized estimating equations; IQR, interquartile range.

^aAdjusted *P* values were adjusted for grade point average, the writer's gender, the duration of time the writer knew the applicant, and the writer's position (employer, faculty, and/or preceptor).

^bStatistically significant difference.

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Table 3. Individual Words Appearing More than 10 Times With Statistical Difference Between Female and Male Applicants

Word Category^a	Female Applicants (n = 320)	Male Applicants (n = 153)	Total (n = 473)	GEE P value	Adjusted GEE P value^b
Amazing	21 (6.6)	4 (2.6)	25 (5.3)	0.071	0.042
Commitment	21 (6.6)	18 (11.8)	39 (8.2)	0.039	0.013
Competent	10 (3.1)	13 (8.5)	23 (4.9)	0.009	0.005
Curio\S*	16 (5.0)	15 (9.8)	31 (6.6)	0.050	0.047
Diligen\S*	23 (7.2)	20 (13.1)	43 (9.1)	0.043	0.047
Independ\S*	268 (83.8)	115 (75.2)	383 (81.0)	0.033	0.023
Outstanding	75 (23.4)	24 (15.7)	99 (20.9)	0.047	0.051
Respons\S*	184 (57.5)	71 (46.4)	255 (53.9)	0.031	0.031
Unique	55 (17.2)	14 (9.2)	69 (14.6)	0.014	0.011
Wonderful	29 (9.1)	6 (3.9)	35 (7.4)	0.045	0.057

Abbreviation: GEE, generalized estimating equations.

^a\S* represents wild card text.

^bAdjusted *P* values were adjusted for grade point average, the writer's gender, the duration the writer knew the applicant, and the writer's position (employer, faculty, and/or preceptor).

Box 1. Sections of the PhORCAS Letter of Recommendation for PGY1 Applicants

Characteristics Scoring Definition

- Exceeds = the candidate exceeds what is expected to enter a residency program
- Appropriate = the candidate performs appropriately for what is expected to enter a residency program
- Fails to meet = the candidate fails to meet the level expected to enter a residency program
- N/A = not applicable or not observed

Characteristics Evaluated

- | | | |
|---|--|---|
| • Writing skills (clinical, email, and assigned writings) | • Ability to work with peers and communicate effectively | • Independence and resourcefulness |
| • Oral communication skills | • Clinical problem solving skills | • Willingness to accept constructive criticism |
| • Leadership/mentoring skills | • Effective patient interactions | • Emotional stability and maturity |
| • Assertiveness | • Dependability | • Professionalism (professional attire and professional demeanor) |
| • Ability to organize and manage time | | |

Narrative Comments

- Please describe the nature of your interactions with the candidate. Under a period of normal workload or abnormal? Frequency or number of directly observed clinical activities of the candidate? The degree of independence the candidate was given? Was that independence reduced or increased over the duration of a rotation? How did the candidate's skills compare with (in order of preference) concurrent residents, peer students or students from other colleges?
 - Please provide 2 strengths of this candidate and how you believe these strengths will be beneficial to his/her success in a residency program.
 - Please provide 2 areas for improvement of this candidate and how you believe a residency program will be able to work with the candidate's noted areas for improvement.
 - Please feel free to address any other characteristics or observances of the candidate not mentioned previously.
-

Figure 1

Gendered Terms	Grindstone	Standout	Activities	Inventive/ Curious	Consistent/ Cautions
Lady	Deliberate	Best	Athlete	Artistic	Conventional
Man	Hardworking	Leader	Research	Imaginative	Cautious
Woman	Tenacious	Prodigy	Volunteer	Open minded	Pragmatic
Efficient/ Organized	Easygoing/ Careless	Outgoing/ Energetic	Solitary/ Reserved	Friendly/ Compassionate	Hedgers
Common sense	Care free	Charisma	Independent	Affable	Probably
Dependable	Flexible	Chatty	Quiet	Likable	Appears
Fastidious	Laid back	Popular	Reserved	Team player	Believe
Sensitive/ Nervous	Secure/ Confident	Communal	Desire	Social	Agentic Personality
Anxiety	Balanced	Agreeable	Keep	Children	Able
Depression	Composed	Caring	Recruit	Couple	Competitive
Vulnerable	Poised	Nice	Stay	Family	Proactive