




# Imposter Syndrome Relation to Gender Across Osteopathic Medical Schools

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## Abstract

This study explores the rate of Imposter Syndrome (IS) in osteopathic medical students specifically in regard to gender. Additionally, we compare IS with previous performance on the Medical College Admission Test (MCAT) and undergraduate science GPA. IS has been described as a psychological term that refers to a pattern of behavior wherein people doubt their abilities and have a persistent fear of being exposed as a fraud regardless of adequate external evidence of success. Females in professional fields have been shown to experience IS at a significantly higher rate than their male counterparts, the cause of which is unknown. We performed an anonymous survey distributed to osteopathic medical students in the USA from the classes of 2020–2023. The final data included information from 23 classes across 9 osteopathic medical schools. Students were asked eight questions from the Young Imposter Scale questionnaire to determine if a student had IS. Students were also asked to provide MCAT scores and undergraduate science GPA information. This study confirms that female osteopathic medical students experience IS at a higher rate than their male counterparts. This phenomenon is not dependent on gender ratios in medical school classes, nor is it dependent on previous student success on the MCAT or undergraduate science GPA. This indicates that medical schools need to be aware of IS throughout the student population, not just high-achieving individuals. IS is a significant problem in medical education, which can lead to physician burnout and deteriorating well-being.

**Keywords** Imposter Syndrome · Gender differences · Medical students · Osteopathic

## Introduction

Imposter Syndrome (IS) has been described as a psychological term that refers to a pattern of behavior wherein people doubt their abilities and have a persistent fear of being exposed as a fraud regardless of adequate external evidence of success [1]. There have been numerous studies consistently demonstrating the prevalence of IS among women in the medical profession (reviewed in [2]), as well as medical education including veterinary medicine [3], physician assistant graduates [4], clinical nursing [5], and mental health professionals [6]. IS was first defined by Dr. Pauline Clance and Dr. Suzanne Imes in a paper published in 1978 titled,

“The Imposter Phenomenon in high achieving women: dynamics and therapeutic intervention.” Dr. Clance and Dr. Imes interviewed “highly successful women” and discovered despite external evidence of success, many women lacked their own internal validation and attributed success to luck [7]. Men can also experience IS and one meta-analysis demonstrated that half of the studies it reviewed found no difference IS rates of men and women [8]. Although evidence indicates women more often experience IS than men across many professional fields [1, 2, 7, 8], more research is necessary to validate those claims.

IS has been a topic of interest due to its implications among physicians and medical students. A recent study surrounding medical training found that IS affects both male and female medical students. In this study, a higher incidence of IS in female students was observed [9] this female bias was further confirmed by the same team in follow-up study within third year medical students [10]. This study demonstrates that half of the female students experienced Imposter Syndrome in comparison to a quarter of their male

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counterparts indicating a significant difference in gender prevalence. Arguments have been made that IS adds up to the larger proportion of hurdles faced by females in comparison to men and that this issue could be added up or be exacerbated by the smaller presence of female leadership figures seen in higher institutions and also found within medical training and careers [11]. An opposing argument can be made that focuses on the nature of an individual's upbringing as the reason behind the feelings of self-doubt. This upbringing also being influenced by gender social norms and cultural expectations experienced by individuals [12]. IS is a psychological phenomenon with many contributing factors, although it is not recognized as a psychiatric condition [8].

IS also has a positive correlation to burnout [9]. Research has shown a number of negative effects of physician burnout on the healthcare systems, patients, and physician well-being. Burnout can result in increased medical errors, longer recovery times, lower patient satisfaction, increased physician turnover, reduced productivity, depression, suicidal ideation, and more [13]. A decrease in physician burnout also provides an economic benefit, with one recent study estimating the national cost of physician burnout in the US to be \$4.6 billion [14]. Within osteopathic medical colleges, the American Association of Colleges of Osteopathic Medicine (AACOM) reported in 2019 that 52.6% of the applicant pool was females, an increase of 1.3% since 2018. This increase in female participation in medical education along with the higher rate at which females often present IS [8] increases the relevance of characterizing its effects and its association to pre-established parameters, such as academic performance and gender representation. For this reason, the first main objective of this study is to determine if the rate of IS in osteopathic medical students is associated to gender. Our second main objective was to evaluate if any sign of IS could be indeed a deficiency and predicted by common medical school admission standards such as MCAT performance and undergraduate science GPA. The outcomes of this study present an objective evaluation of gender representation and its overall relation on the gender biased IS risk. Evaluations like the one we present here can guide and support initiatives aimed at fostering gender equality and to promote higher quality education and improve physician and medical student wellness.

## Materials and Methods

### Experimental Design

To evaluate our main objective of determining how gender is related to the rate of IS in medical students, our team collected questionnaire responses across several osteopathic medical colleges and graduation classes. Participants were

assessed for IS via the Young Imposter Scale (YIS). Our decision to use the YIS over other IS standardized surveys such as the Clance Imposter Phenomenon Test was twofold. First, the YIS was used in peer reviewed studies [15–18], and there is currently no standard for IS scoring [19]. Second, the YIS is a shorter survey (8 questions) thus leading to greater participation and a stronger statistical study. Our study has observational and cross-sectional characteristics. Respondents were asked to provide their MCAT scores and undergraduate science GPA to evaluate its association to IS.

### Participants and Imposter Syndrome Determination

Medical students were invited to participate from a total of 14 osteopathic medical institutions in the USA; however, only 9 of those submitted enough questionnaire responses for being included in the study. The survey was deployed two times, internally within RVU during September 2019 and outside of RVU during February–April 2020. The inclusion criteria for this preselection step were to have at least 2 responses per sex within a specific graduating class. The nine institutions included in this study are mentioned in Table 2. Students in their institutions were approached through their Student Government Presidents who agreed to distribute our survey and through direct recruitment from investigators. Students who participated in this study belonged to graduating classes of 2020 through 2023. Specific male-to-female ratios by graduating class were obtained from public records made available by each of the participating institutions.

As discussed previously, IS was assessed through the YIS questionnaire [9, 15]. This questionnaire consists in eight dichotomous Yes/No questions that evaluate IS risk. We determined a person had IS when five or more of these answers were answered as “Yes” as defined in previous studies [9]. Full questionnaire is presented in Table 1.

All the participants in this study contributed their responses voluntarily and did not receive any type of compensation for their participation. Each participant was provided with a disclosure that explained the details of our study to which they had to consent for participating. Our study was vetted by our Institutional Review Board (RVU IRB #2019–0054) which determined that no risk was posed to participants.

### Statistical Analysis

The first main objective of this study was evaluated through a generalized linear model with a binary response (IS: present/not present) that included exclusively the interaction effect of College by Campus by Class by Gender which isolated the fixed effect defined as our main goal. The College and Campus parameters were included

**Table 1** Young Imposter Scale Questionnaire (Yes/No)

1. Do you secretly worry that others will find out that you're not as bright and capable as they think you are?
2. Do you sometimes shy away from challenges because of a nagging self-doubt?
3. Do you tend to chalk your accomplishments up to being a "fluke," "no big deal" or the fact that people just "like" you?
4. Do you hate making a mistake, being less than fully prepared, or not doing things perfectly?
5. Do you tend to feel crushed even by constructive criticism, seeing it as evidence of your "ineptness?"
6. When you do succeed, do you think "Phew, I fooled them this time, but I may not be so lucky next time?"
7. Do you believe that other people (students, colleagues, competitors) are smarter and more capable than you?
8. Do you live in fear of being found out, discovered, or unmasked?

to accommodate for Rocky Vista University which had two campuses meeting the requirements for inclusion in the analysis. The first main objective model can be defined as:

$$IS(\text{present/not present})_{ijkl} = \text{College}_i \times \text{Campus}_j \\ \times \text{Class}_k \times \text{Gender}_l + \text{error}_{ijkl}$$

where all the parameters were included as fixed effects, and errors were assumed as normally distributed with mean zero and variance  $\sigma^2$ . Pairwise parameter estimates differences were only considered for comparisons across genders within the same institution and graduating class; therefore, the study only included 23 valid trials by this criterion, each class year cohort is the experimental unit. The presence of significant IS within an institution and graduating class was determined through the outcome of the Type 3 test for the fixed interaction effect. Ultimately, the determination of an association to gender was made through a binomial trial probability distribution of the total 23 trials at an  $\alpha = 0.05$  compared to a test statistic that would consist in the number of significant trials within institution and graduating class detected through the main goal model.

To evaluate our second main objective of the relationship of IS and common medical school admission standard scores (MCAT and Science GPA), we used as well a generalized linear model with a binary response that included the additive fixed effects of MCAT, Science GPA as the main effects along with their interaction effect along with the gender effect. This second main objective model can be defined as:

$$\text{Log}_e(IS(\text{present/not present}))_{ijk} = \beta_0 + \beta_1 \text{MCAT}_i + \beta_2 \text{ScienceGPA}_j \\ + \beta_3 \text{MCAT}_i \times \text{ScienceGPA}_j + \beta_4 \text{Gender}_k + \text{error}_{ijk}$$

which uses a *t*-test to evaluate the beta coefficient difference from zero. This model was used as well to assess the itemized responses of the YIS. All statistical analyses were performed with SAS v.9.4 (SAS Institute, Cary, NC). All the models were performed through PROC GLIMMIX. All the descriptive statistics were estimated through PROC FREQ.

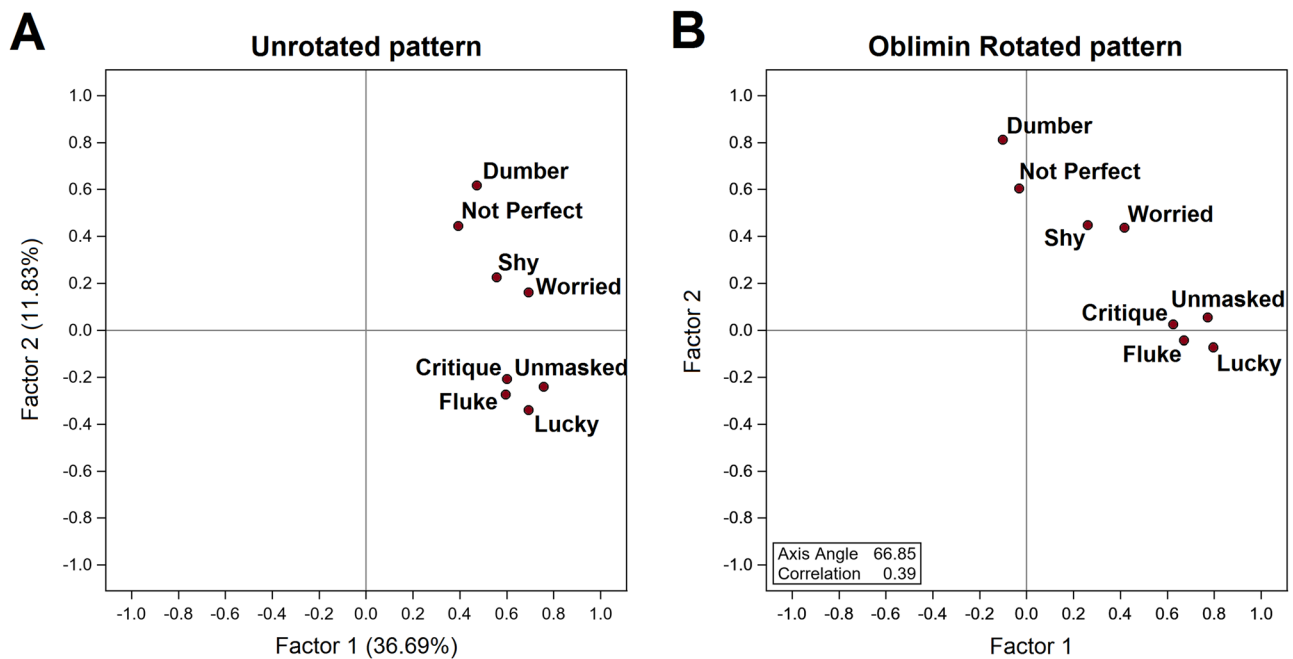
Cronbach's  $\alpha$  was estimated to evaluate internal validity of the questionnaire responses, while factor analysis

using the principal component method was used to provide a broad dimensional analysis of the YIS. To assist on dimensional interpretation, an Oblimin pattern rotation was used to align the axes. Correlation analysis for Cronbach's  $\alpha$  was estimated through PROC CORR, while factor analysis was performed using PROC PRINCOMP and PROC FACTOR.

## Results

The present study included a total of 600 (301 females vs. 299 males) participants from 9 osteopathic medical schools in the USA. Internal validity of YIS as estimated from this cohort of participants was assessed by Cronbach's  $\alpha$  which displayed a satisfactory standardized value of 74.36%. Using the deleted question approach, no questions in particular increased the validity significantly when removed. This suggests that all the questions are reliable and reflect closely the response pattern of participants without any major ambiguity. We performed a dimensional evaluation of the YIS through factor analysis. Patterns are presented in (unrotated and Oblimin rotated) Fig. 1. The analysis revealed that the YIS is multidimensional with at least two dimensions that for some questions have no overlap. Questions inquiring on being lucky, being a fluke, being unmasked, and being critiqued lined up in one dimension, while questions inquiring on being dumber or not perfect lined up in a secondary dimension. Questions inquiring on shyness and being worried displayed some overlap. These dimensions suggest two main dimensions; the first main dimension pertains to the self-interpretation of the peer's perceptions (lucky, being a fluke, being unmasked, and being critiqued), while the secondary main dimension pertains to the self-assessment of oneself (being dumber or not perfect).

To evaluate the first main objective, we used a generalized linear model with a binary response to determine how the gender affects the rate of IS in medical students. We used the quadruple interaction effect specifically to isolate the effect, since the main effect estimates and lower order



**Fig. 1** Dimensional evaluation of Young Imposter Scale ( $N=600$ ). **A** Unrotated pattern. **B** Oblimin-rotated pattern

interactions have no relevance for the question. Estimate differences by gender for each class, campus and college are presented in Table 2, as these are the experimental units of our approach. The interaction effect tested in the model was statistically significant ( $P=0.000977$ ). A total of four out of twenty-three outcomes were significantly associated to IS. Using a binomial probability distribution, the probability of four out of twenty-three outcomes is 0.02088 which suggests to some extent the existence of Imposter Syndrome differences across college campus, class, and gender. Although IS is more common among female osteopathic medical students ( $P=9.59E-07$ ), falling in line with previous studies in allopathic medical schools [9], our outcome suggests the existence of a small effect that is barely detectable using our binomial probability distribution assessment.

To evaluate our second main objective, we used a generalized linear model with a binary response that included the additive fixed effects of Science GPA, MCAT scores as main effects along with their interaction effect in addition to a fixed Gender effect. Neither Science GPA, MCAT score, nor their interaction were statistically significant as predictors of IS but Gender was ( $P=0.000023$ ). Maximum likelihood estimates and  $P$ -values are displayed in Table 3.

Further exploration of the specific questions described in Table 1 fitted through the same model as in our second objective detected a very similar pattern for several questions where only the gender effect was found significant for questions 1, 2, 3, 5, and 7 with positive estimate for each of them. These do not match directly the main dimensions

identified through factor analysis but are suggestive of a specific profile that may be sex specific. These associations are summarized and presented in Table 4. Our results suggest that the etiology of IS in females has a specific component that is captured by these specific questions.

## Discussion

Survey results and analysis found that IS is more common among female osteopathic medical students. This is in line with what previous studies have shown in allopathic medical schools [9], as well other professional careers. However, when broken down by class and campus the results showed no significant relationship between gender and the likelihood of females to experience IS. This information indicates that the number of female peers is not a factor that could directly affect whether an individual would experience IS. This information is encouraging for osteopathic medical education seeking to understand rates of IS in student populations. While there should be continual effort made to diversify gender representation, the lack of female gender representation in a medical class is not directly associated with higher rates of IS in female students.

As medical school classes continue diversifying in regard to gender, it would be valuable to see if the incidence of IS was to increase in male students in classes with low male-to-female ratios. Our data found only 4 classes out of the

**Table 2** Pairwise comparison tests by gender, college, campus, and graduating class of Imposter Syndrome least square means estimate differences

College	Campus	Graduating class	Participants in this study	Class gender in the class %		IS estimate difference	95% Confidence intervals	P
				Male %	Female %			
A. T. Still University of Health Sciences	Kirksville, MO	2022	16	62	38	0.125	(−0.3410–0.5910)	0.5985
		2023	19	52	48	0.0476	(0.3956–0.4909)	0.8330
Burrell College of Osteopathic Medicine	Las Cruces, NM	2020	5	54	46	−0.6667	(−1.5175–0.1841)	0.1243
		2022	10	49	51	0.0000	(−6.016–6.016)	1.0000
		2023	18	50	50	−0.4167	(0.8827–0.0493)	0.0796
Des Moines University	Des Moines, IA	2022	27	56	44	0.2582	(0.1007–0.6172)	0.1582
		2023	10	58	42	0.3333	(−0.2683–0.9349)	0.2769
Idaho College of Osteopathic Medicine	Meridian, ID	2022	26	65	35	−0.0833	(−0.4500–0.2833)	0.6555
		2023	35	62	38	0.4094	(0.0775–0.7413)	<b>0.0157*</b>
Ohio University Heritage College of Osteopathic Medicine	Athens, OH	2022	13	51	49	0.2778	(−0.2823–0.8378)	0.3304
Rocky Vista University College of Osteopathic Medicine	Parker, CO	2020	38	50	50	0.5188	(0.2095–0.8282)	<b>0.0010*</b>
		2021	31	64	36	−0.0756	(−0.4120–0.2607)	0.6589
		2022	41	45	55	0.3049	(−0.0079–0.6177)	0.056
	Ivins, UT	2023	50	51	49	0.0747	(−0.1968–0.3463)	0.5892
		2021	29	81	19	0.2532	(−0.1512–0.6577)	0.2192
		2022	55	69	31	0.3934	(0.1256–0.6612)	<b>0.0041*</b>
Touro College of Osteopathic Medicine	New York, NY	2023	63	68	32	0.1429	(−0.1062–0.3919)	0.2604
		2022	27	51	49	0.0000	(−0.3805–0.3805)	1.0000
		2023	22	44	56	0.2571	(−0.1695–0.6838)	0.2369
West Virginia School of Osteopathic Medicine	Lewisburg, WV	2020	20	52	48	0.1758	(−0.2611–0.6128)	0.4296
		2021	5	46	54	0.6667	(−0.1841–1.5175)	0.1243
		2022	13	52	48	0.6389	(0.0788–1.1990)	<b>0.0254*</b>
		2023	27	55	45	−0.1118	(−0.4832–0.2597)	0.5547

\*Statistically significant pairwise comparison

23 analyzed that had fewer than 50% male students and we were not able to draw any statistically significant conclusions based on that data.

Based on the data received and its statistical evaluation, the authors found that there is no significant association between IS, MCAT performance, and cumulative science GPA. The scoring criteria for medical education entrance do not seem to play a role in IS during medical education. This suggests that IS could be more of a psychological phenomenon, separate from previous student performance. Often, IS is thought to affect high-achieving individuals, more often

women than men. It is certainly interesting that those with advanced career training and accomplishments experience IS at similar rates to individuals with respectively less career experience and accomplishments [20]. Nonetheless, there are contrasting arguments such as those discussed by Wang et al. in 2019, where IS is shown to be a link between perfectionism and anxiety but also served as a partial mediator to depression. Although Imposter Syndrome has a positive link to perfectionism, there is a need to clarify a point of imperfection to prevent depression caused by perfectionism [21]. Due to this, IS should be monitored in all medical students

**Table 3** Analysis of maximum likelihood estimates of Imposter Syndrome

Parameter	Estimate	Standard Error	DF	t	P
Intercept	18.600	24.157	8	0.77	0.4634
Science GPA	−5.291	6.832	581	−0.77	0.4390
MCAT Score	−0.041	0.048	581	−0.85	0.3962
Science GPA* MCAT Score	0.011	0.014	581	0.82	0.4121
Gender = female	0.753	0.176	581	4.27	<b>2.3E−05*</b>

\*Statistically significant

**Table 4** Association summary for itemized Young Imposter Scale questions

Question	Science GPA	MCAT Score	Science GPA* MCAT Score	Gender	Log odds estimate Female vs. male
1. Do you secretly worry that others will find out that you're not as bright and capable as they think you are?	0.1670	0.1869	0.1784	<b>5.9E-10*</b>	1.102
2. Do you sometimes shy away from challenges because of a nagging self-doubt?	0.8452	0.9371	0.9307	<b>0.0003*</b>	0.616
3. Do you tend to chalk your accomplishments up to being a "fluke," "no big deal," or the fact that people just "like" you?	0.1163	0.1184	0.1167	<b>0.0003*</b>	0.622
4. Do you hate making a mistake, being less than fully prepared, or not doing things perfectly?	0.5415	0.6525	0.5529	0.158	0.555
5. Do you tend to feel crushed even by constructive criticism, seeing it as evidence of your "ineptness"?	0.8490	0.7879	0.8195	<b>0.0001*</b>	0.712
6. When you do succeed, do you think "Phew, I fooled them this time, but I may not be so lucky next time"?	0.5061	0.5908	0.5389	0.0201	0.437
7. Do you believe that other people (students, colleagues, competitors) are smarter and more capable than you?	0.3728	0.3318	0.3622	<b>0.0005*</b>	0.774
8. Do you live in fear of being found out, discovered, or unmasked?	0.8987	0.8749	0.8731	0.0072	0.524

\*Statistically significant to a Bonferroni corrected  $\alpha=0.05$

despite performance, as medical students are often some of the highest academic achievers. IS, in turn, impacts negatively on the well-being of students in their path to become a physician. Identifying and addressing IS in all osteopathic medical students has potential to benefit future physicians with longer and better career attitudes.

Burnout is an important result of IS as we discussed earlier in the paper. Addressing student's IS early in their medical education could reduce the risk of burnout in the future physician populations. Current and future research can help identify students suffering from IS and allow them to obtain assistance in managing IS. Achieving lower levels of IS among medical students could potentially decrease the incidence of burnout in the future and lead to improved patient care.

It is worth considering the ways that women were more prone to IS through the questionnaire. Our survey results demonstrated trends for which gender was more likely to say yes to a certain question in the Young Imposter Scale. In question 1, women were more worried than men about being found out that they were not as bright as expected. In contrast, question 8 asks a similar question about being found out or unmasked, which was not significantly different between men and women. The two questions are similar, but question 8 seems to indicate greater thoughts of ineptness than question 1. This seems to indicate that female osteopathic medical students simply do not have the same confidence in their intelligence as their male counterparts. Similarly, question 6 seems like an indication of a more severe display of ineptness as female students are fooling everyone but may not get so lucky next time. Both in questions 6 and 8, females did not answer the questions at a rate significantly

higher than male students. Question 5 specifically points to a lack of confidence female students may have in themselves as it shows that females more often than males are crushed by any type of criticism. Further research into this specific item could yield impactful results, specifically in clinical training where criticism is necessary for the student to improve. However, it is imperative to address the lack of development in some of the tools available. Although the YIS has been used in published studies, there is little information available exploring the specific constructs it measures. An interesting follow-up would be to compare this tool to others available such as Clance's Imposter Phenomenon Scale [22]. In this study we made evident that the tool is multidimensional but is not enough to clarify this gap. A clear understanding of the psychometric properties of the tool is necessary for the development of effective interventions. Successful identification and treatment of IS in medical students early will directly benefit patients in the future by improving physician well-being and creating better healthcare outcomes.

## Conclusion

Female osteopathic medical students experience IS at a higher rate than their male counterparts. This phenomenon is not dependent on male-to-female ratio in medical school classes. IS is not dependent on previous student success on the MCAT or undergraduate science GPA. This indicates that medical schools need to be aware of IS throughout the student population by monitoring them, this being independent of a student being a high-achiever or not. IS can be a

problem in medical education that adds up to other factors and could contribute to physician burnout. It is essential that future research continue to explore different aspects of IS to provide medical schools with the best information to identify and assist these students to avoid issues with anxiety and depression.

**Author Contribution** All the authors contributed to the study conception, design, material preparation, and data collection. Analysis was performed by Isain Zapata. All the authors participated in the development of the manuscript, and all approved the final version.

**Data Availability** De-identified raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Declarations

**Ethics Approval** This study was approved by the Rocky Vista University Institutional Review Board (RVU IRB #2019–0054).

**Conflict of Interest** The authors declare no competing interests.

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