Research Article

Which Attributes Explain Gender Differences in Impostor Syndrome Scores in Medicine and Health Sciences Students: A Secondary Multivariate Analysis

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Impostor Syndrome (IS) is a psychological pattern where individuals doubt their accomplishments and fear being exposed as frauds, despite evidence of success. This study investigates gender differences in IS among 753 medical and health sciences students and graduates, using the Clance Impostor Phenomenon Scale. We aim to discern item-specific gender disparities in IS manifestations and develop a canonical variable that encapsulates these differences. Our findings reveal significant disparities: women display higher scores related to self-doubt and fear of failure, while specific IS aspects in men are associated with overcompensation. These insights suggest the need for gender-specific educational and clinical strategies to address IS in medicine and health sciences. By employing a multivariate analysis of variance, this study refines our understanding of how IS differently affects genders, aiding in the design of targeted interventions that can enhance well-being and professional efficacy among future healthcare professionals. Such strategies are crucial, emphasizing the importance of creating supportive environments to foster resilience in these high-stakes fields.

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1. Introduction

Imposter Syndrome (IS) is defined as a psychological state where individuals doubt their accomplishments and fear being exposed as a fraud, despite clear evidence of their competence[1]. This syndrome is not confined to, but is especially prevalent among high achievers who struggle to accept their successes, often attributing them to luck or external factors rather than their own merit[2]. Studies suggest that IS affects up to 70% of people at some point, particularly during new and challenging tasks[3], with a noted higher incidence in women across various professions[4].

In the high-pressure, high-stakes environment of healthcare, IS is notably common and has been well-documented among medical residents and other healthcare professionals[5][6][7]. The hierarchical nature of the sector exacerbates these feelings, particularly among junior staff. The repercussions of IS in healthcare are significant, potentially compromising patient care and leading to professional burnout, anxiety, and depression among healthcare workers[2][4]. Research has underscored the prevalence and detrimental effects of IS on healthcare workers and students, revealing that a significant proportion of novice nurses and nutrition and dietetics professionals experience these feelings, which can diminish with age, higher education, and professional experience[5][8]. This highlights the importance of supportive educational strategies to foster confidence and independent practice in healthcare students and professionals[9].

The prevalence of IS exhibits notable gender disparities across various professions, underscoring the complexity of its manifestation; for review see[10]. For example, Villwock et al.[11] reported that female medical students were significantly more likely to experience IS symptoms, with 49.4% of females affected compared to only 23.7% of males. In addition, in a study on a sample of 115 kinesiologists and trainers, Petrič[12] explored IS prevalence without finding a significant gender difference, indicating the nuanced nature of IS across different sectors. Despite these findings highlighting gender differences in various professional contexts, some studies have also produced contrasting results[13][14]. These contrasting findings suggest that while gender may influence the experience of IS, the relationship is complex and may be moderated by factors such as professional context and societal expectations.

Previous research has used various scales to evaluate IS[15]. Although the selection of the most appropriate scale continues to be a subject of discussion and investigation, the Clance Impostor Phenomenon Scale (CIPS) stands out as one of the scales most commonly utilized in this area of study.

According to the majority of the literature, we observed higher CIPS scores for women compared to men when examining physical therapy students[16], medical students[17], as well as students and graduates of health sciences (unpublished results). However, relying solely on cumulative scores for designing personalized interventions to prevent or mitigate IS may not be entirely informative. Notably, evaluations of individual items on the Clance Impostor Phenomenon Scale (CIPS) have shown significant variability between genders and among the items themselves in earlier research[18][19]. Brauer & Proyer implemented principal component analysis and proposed that at least three subfactors—Luck, Fear of Failure, and Discount—could be discerned from the questionnaire, beyond the aggregate score[19]. Although principal component analysis facilitates the identification of latent constructs within a comprehensive set of variables, it does not inherently delineate gender disparities in total scores. Moreover, analysing gender differences item-by-item risks elevating the false discovery rate. In this study, we employed multivariate analysis of variance (MANOVA) to ascertain item-specific gender disparities and to formulate a canonical (composite) variable from individual items, optimizing the distinction between genders. Through an examination of the individual item weights, our analysis aims to identify which items predominantly contribute to the observed gender differences. Recognizing the items most associated with increased IS in each gender could enhance the customization of intervention strategies.

2. Methods

2.1. Participants and data collection

This study involved a secondary analysis using a database that authors have collected over multiple previous studies[16][17] and unpublished results. Database contained 207 medical students, as well as students (n = 477) and recent graduates (n = 69) of health sciences (physiotherapy, nursing, kinesiology and nutritional counselling). In all previous analyses, only gender emerged as a predictor of total CIPS score. The data was collected via an online survey which was disseminated through emails by a non-involved administrative staff member to medical and healthcare faculties across Slovenia. We used the 1KA platform, a prevalent online system for survey data collection in Slovenia. Prior to survey commencement, respondents were provided with an information sheet outlining study objectives and confidentiality safeguards, necessitating consent via a checkbox for study participation. This participation was strictly voluntary, with no financial incentives offered. Ethical endorsement was

granted by the National Medical Ethics Committee of Slovenia (approval number 0120-690/2017/8), ensuring adherence to ethical standards laid out in the Declaration of Helsinki.

2.2. Questionnaire

The initial part of the survey was designed to collect basic demographic information (gender, age, study year) along with data on prior clinical experiences. In this context, "prior clinical experiences" encompassed any direct patient care activities, including internships, shadowing, or other clinical roles involving patient interaction, with a clarification provided for clarity. Subsequent sections featured the Clance Impostor Phenomenon Scale (CIPS), a tool with established validity for assessing Impostor Syndrome (IS) and previously adapted into Slovenian, and showing high internal consistency. Comprising 20 items, the CIPS evaluates IS manifestations through a 5-point Likert Scale, covering aspects such as perceived intellectual fraudulence, fear of evaluation, apprehension regarding sustained success, and success attribution to luck. The list of items is provided in Table 1.

Abbreviation	Description
Q1	1. I have often succeeded on a test or task even though I was afraid that I would not do well before I undertook the task.
Q2	2. I can give the impression that I'm more competent than I really am.
Q3	3. I avoid evaluations if possible and have a dread of others evaluating me.
Q4	4. When people praise me for something I've accomplished, I'm afraid I won't be able to live up to their expectations of me in the future.
Q5	5. I sometimes think I obtained my present position or gained my present success because I happened to be in the right place at the right time or knew the right people.
Q6	6. I'm afraid people important to me may find out that I'm not as capable as they think I am.
Q7	7. I tend to remember the incidents in which I have not done my best more than those times I have done my best.
Q8	8. I rarely do a project or task as well as I'd like to do it.
Q9	9. Sometimes I feel or believe that my success in my life or in my job has been the result of some kind of error.
Q10	10. It's hard for me to accept compliments or praise about my intelligence or accomplishments.
Q11	11. At times, I feel my success has been due to some kind of luck.
Q12	12. I'm disappointed at times in my present accomplishments and think I should have accomplished much more.
Q13	13. Sometimes I'm afraid others will discover how much knowledge or ability I really lack.
Q14	14. I'm often afraid that I may fail at a new assignment or undertaking even though I generally do well at what I attempt.
Q15	15. When I've succeeded at something and received recognition for my accomplishments, I have doubts that I can keep repeating that success.
Q16	16. If I receive a great deal of praise and recognition for something I've accomplished, I tend to discount the importance of what I've done.
Q17	17. I often compare my ability to those around me and think they may be more intelligent than I am.

Abbreviation	Description
Q18	18. I often worry about not succeeding with a project or examination, even though others around me have considerable confidence that I will do well.
Q19	19. If I'm going to receive a promotion or gain recognition of some kind, I hesitate to tell others until it is an accomplished fact
Q20	20. I feel bad and discouraged if I'm not "the best" or at least "very special" in situations that involve achievement.

Table 1. List of CIPS items

2.3. Statistical analysis

Data were analysed statistically using IBM SPSS software (version 27.0). Descriptive statistics were presented as means and standard deviations. A multivariate analysis of variance (MANOVA) was performed with gender as a fixed factor and individual CIPS items as dependent variables. Box's Test of Equality of Covariance Matrices was performed. Given the statistically significant result ($p < 0.001$), the Pillai's Trace statistics was used in MANOVA, considering its robustness to non-homogeneity of variances[20]. Main effect of gender and item-specific gender differences were analysed, with effect sizes expressed as partial eta-squared (η^2). Further, a canonical (composite) variable was constructed that best predicts the gender explains the gender differences. Raw and standardized coefficients for each item were calculated, where a positive sign indicated that the specific item contributed to a higher composite score in females. Finally, a descriptive statistics and independent samples t-test were performed on the composite variable. For all analyses, the threshold for statistical significance was set at $\alpha < 0.05$.

3. Results

The questionnaire showed high internal consistency for total sample ($\alpha = 0.92$), men only (($\alpha = 0.91$) and women only ($\alpha = 0.92$). The total CIPS score was statistically significantly higher in women (60.2 ± 14.4) than men (54.9 ± 14.9) with a small effect size ($F = 16.2$; $p < 0.001$; $\eta^2 = 0.02$). Accordingly, MANOVA revealed a statistically significant difference between men and women across the 20 questionnaire items ($F = 4.72$; $p < 0.001$; $\eta^2 = 0.11$). Table 2 shows item-specific differences. Gender differences varied

substantially across items. For instance, Q1, Q3, Q4, Q5, Q6, Q10, Q11, Q12, Q13, Q14, Q15, Q17 and Q18 had higher scores in women ($p = 0.001 – 0.047$). Conversely, Q2 was higher in men ($p = 0.004$). Finally, Q7, Q8, Q16, Q19 and Q20 did not exhibit gender differences ($p = 0.055 – 0.851$).

Item	Male		Female		MANOVA		
	Mean	SD	Mean	SD	F	p	η^2
Q1	3.75	0.97	3.98	0.78	8.94	0.003	0.012
Q2	3.26	1.10	2.98	1.07	8.25	0.004	0.011
Q3	2.68	1.12	2.96	1.12	7.30	0.007	0.010
Q4	2.63	1.33	3.07	1.23	14.7	0.000	0.019
Q5	1.85	1.09	2.07	1.18	3.98	0.047	0.005
Q6	2.39	1.37	2.85	1.34	14.0	0.000	0.018
Q7	3.06	1.29	3.27	1.18	3.69	0.055	0.005
Q8	2.78	1.09	2.75	1.08	0.10	0.757	0.000
Q9	1.88	1.13	2.19	1.19	8.28	0.004	0.011
Q10	2.81	1.31	3.19	1.26	10.3	0.001	0.014
Q11	2.26	1.22	2.57	1.18	7.94	0.005	0.010
Q12	3.26	1.12	3.51	1.01	6.91	0.009	0.009
Q13	2.93	1.36	3.31	1.18	11.3	0.001	0.015
Q14	2.9	1.17	3.34	1.10	18.1	0.000	0.024
Q15	2.33	1.17	2.74	1.17	14.6	0.000	0.019
Q16	2.31	1.30	2.33	1.20	0.04	0.851	0.000
Q17	2.87	1.31	3.59	1.18	41.7	0.000	0.053
Q18	2.77	1.12	3.28	1.11	24.8	0.000	0.032
Q19	3.3	1.21	3.32	1.21	0.04	0.838	0.000
Q20	2.83	1.29	2.93	1.25	0.79	0.373	0.001

Table 2. Multivariate analysis of variance

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SD – standard deviation

Table 3 displays raw and standardized coefficients that are generated to form the canonical (composite) variable. The composite variable had a mean score of 0.51 ± 1.03 in men and 1.04 ± 0.99 in women, with a mean difference of 0.89 (95% CI = 0.71 – 1.07). As expected, this difference was statistically significant (F = 96.95; p < 0.001), with the same effect size as found in the main effect of MANOVA (η^2 = 0.11). The item that contributed the most to the higher scores in females was Q17 (*"I often compare my ability to those around me and think they may be more intelligent than I am"*). This was followed by Q18 (*"I often worry about not succeeding with a project or examination, even though others around me have considerable confidence that I will do well"*), Q1 (*"I have often succeeded on a test or task even though I was afraid that I would not do well before I undertook the task*") and Q12 (*"I'm disappointed at times in my present accomplishments and think I should have accomplished much more"*) (Table 3). Two factors stood out that contributed to the higher scores in men – Q2 (*"I can give the impression that I'm more competent than I really am"*) and Q8 (*"I rarely do a project or task as well as I'd like to do it*").

Item	Raw Coefficients	Standardized coefficients	Correlation with composite variable
Q1	0.20	0.17	0.30
Q2	-0.41	-0.44	-0.29
Q3	0.02	0.02	0.27
Q4	0.08	0.11	0.39
Q5	0.06	0.07	0.20
Q6	0.14	0.18	0.38
Q7	-0.06	-0.07	0.20
Q8	-0.48	-0.52	-0.03
Q9	0.14	0.16	0.29
Q10	0.04	0.05	0.33
Q11	0.01	0.02	0.29
Q12	0.20	0.21	0.27
Q13	-0.02	-0.03	0.34
Q14	0.02	0.02	0.43
Q15	0.06	0.08	0.39
Q16	-0.29	-0.35	0.02
Q17	0.55	0.66	0.66
Q18	0.23	0.26	0.51
Q19	-0.09	-0.11	0.02
Q20	-0.18	-0.23	0.09

Table 3. Coefficients used to form the canonical (composite) variable

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4. Discussion

This study aimed to explore the gender differences in IS among students in medicine and health sciences, utilizing a secondary multivariate analysis of existing database that authors have collected over several previous studies[16][17]. Our secondary exploratory analysis reflects the complex manner in which IS manifests across genders. The application of multivariate analysis in our study enabled a more detailed understanding of gender differences in IS scores. By constructing a canonical variable from individual CIPS items, we were able to pinpoint the attributes that most significantly contribute to the gender disparity in IS scores.

The significant gender differences in overall CIPS scores align with existing literature that indicates women are more prone to experiencing IS than men[10][11]. With our multivariate item-specific analysis, we identified certain items that were predominant drivers of overall scores in each gender. Particularly, items that are purported to reflect self-doubt, fear of failure, and attributing success to external factors (e.g., Q17, Q18, Q1, Q12) were more strongly associated with higher IS scores among female participants. This is partially aligned with a previous study in third-year medical students, where women exhibited statistically significantly higher scores in Q17 and Q18 items, but not other items[18]. Psychological research provides some insight into the internalization of societal norms and expectations, suggesting that women may be more susceptible to impostor feelings due to ingrained beliefs about their roles and capabilities[21]. This susceptibility is further exacerbated in environments where they are minorities, such as in certain specialties within medicine and health sciences, where the historical dominance of men can intensify feelings of being an outsider and foster a sense of not belonging[7]. Societal and cultural expectations often place undue pressure on women to demonstrate their competence and worth continually. This external validation-seeking behaviour could be linked to the fear of failure and self-doubt highlighted in our findings (Q17, Q18). Particularly within the medical field, women may therefore experience a heightened sense of scrutiny, both self-imposed and from external sources, which can amplify IS symptoms[22]. For instance, studies have shown that women's successes are often attributed to luck or timing rather than skill or intelligence, reinforcing the impostor phenomenon[22][23] In contrast, when men achieve, their success is more frequently attributed to innate abilities and hard work, which can bolster their self-confidence and mitigate feelings associated with IS.

Interestingly, our study also identified items that were particularly predictive of overall IS scores in men, particularly Q2 and Q8. This observation suggests that impostor feelings among men, though less

prevalent compared to women, may be related to overcompensation (Q2) or perfectionism (Q8). We are not aware of any studies that would investigate overcompensation in medical or healthcare education. Furthermore, research in perfectionism is controversial and gender differences appear to be context-specific. For example, one study among intercollegiate student-athletes found that men tended to have higher perfectionist tendencies than women in the sport domain, but not in the academic domain[24]. Perfectionism seems to be increasing with time, irrespective of gender[25]. It is important to emphasize that our analysis did not show a statistically significant difference in Q8; rather Q8 item had a relatively larger weight when predicting overall IS score in men. Therefore, it can be concluded that perfectionism could be similar among genders, while its contribution to IS seem to be particularly important in men. Further research exploring overcompensation and perfectionism traits in relation to IS is warranted.

The implications of these findings are manifold. Firstly, they underscore the need for gender-specific approaches in educational and clinical settings to address IS. Interventions could be tailored to target the specific manifestations of IS identified in this study, such as workshops focused on combating self-doubt and fear of failure among women, and addressing the pressure to appear competent among men. Secondly, these insights could inform curriculum design and mentorship programs in medical and health sciences education, incorporating strategies to bolster self-efficacy and resilience against the adverse effects of IS. Addressing these gender-specific experiences requires a multifaceted approach. Educational and professional environments should not only promote gender equity but also actively work to dismantle stereotypes and biases that fuel the impostor phenomenon. Mentorship programs, particularly those that provide women with female role models who have navigated similar challenges, can be instrumental in this regard. Such programs can offer both practical advice and psychological support, challenging impostor feelings by validating women's experiences and achievements. Peers of the affected person also play an important role in addressing impostor syndrome. They can help by building an empathetic relationship that allows for vulnerability, celebrates peer success, and promotes a positive culture[26]. It is likely that such an approach by peers has a particularly powerful effect on the male gender, who are generally thought to hide their vulnerability among others. Finally, it is important to emphasize the responsibility of the individual to contribute to overcoming IS through individual strategies such as: journaling and reflecting, strengthening self-awareness and self-compassion, visualizing success, rewarding self-accomplishments, embracing confidence, seeking support from mentors/supervisors, exploring family of origin patterns in supervision, and building personal skills such as time management, avoiding procrastination, and recognizing stuck points[26].

Limitations of this study include the reliance on self-reported measures, which may be subject to social desirability bias, and the context-specific nature of the findings, which may not be generalizable to other cultural or professional settings. Future research should aim to replicate these findings in diverse populations and explore the longitudinal impact of tailored interventions on IS scores. Furthermore, the sample lacked balance due to a predominant representation of women; however, this is largely due to higher percentage of women studying and working in healthcare sector. Although the CIPS questionnaire demonstrated high internal consistency in previous research – in general[15] and specifically in Slovenia[16][17] and the current study, alternative assessment tools (e.g., The Young Impostor Scale, The Leary Impostor Scale, The Harvey Impostor Phenomenon Scale or Perceived Fraudulence Scale) might have produced different outcomes. Finally, it has to be emphasized that this was a secondary exploratory analysis of existing data. A confirmatory study, designed specifically for the purpose of revealing gender differences is warranted to further corroborate our results.

5. Conclusion

In conclusion, this study advances our understanding of the gender difference regarding IS in the context of medicine and health sciences education. The findings of this study highlight the importance of recognizing and addressing the unique challenges faced by male and female students in medicine and healthcare education in relation to IS. This understanding is essential for creating a supportive educational environment that fosters resilience against IS, consequently enhancing student well-being, academic performance, and future professional competence.

Statements and Declarations

Competing Interests: The authors report there are no competing interests to declare.

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Data Availability Statement: Raw data may be obtained by request to the corresponding author.

Consent to participate: Informed consent was obtained from all individual participants included in the study. Participants acknowledged their voluntary participation at the beginning of the survey.

Ethics approval: The study was approved by the National Medical Ethics Committee of Slovenia (approval number 0120-690/2017/8) and was conducted in accordance with the Declaration of Helsinki.

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Declarations

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