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ORIGINAL RESEARCH

Persistent and clinically significant impostor phenomenon in postgraduate medical trainees

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Abstract

Background: Impostor phenomenon is common among medical trainees, affecting wellness and professional development. How it varies across the academic year remains unclear.

Methods: This was a prospective repeated measures study of postgraduate medical trainees at the University of Toronto conducted between January 4, 2022 - January 30, 2024. Impostor phenomenon was measured using the Clance Impostor Phenomenon Scale (CIPS). CIPS scores of 61-80 reflect clinically significant impostor phenomenon, while CIPS scores greater than 80 reflect severe impostor phenomenon. In this study, we considered 20-point differences clinically meaningful. Participants completed the CIPS every 12 weeks for 52 weeks. Mixed model regression was used to test the association between CIPS score and time of year.

Results: 110 participants (14.8% response rate) with a total of 406 CIPS scores were included in the analysis. Participants were mostly between 25-30 years old (72.7%), internal medicine trainees (45.5%), and in postgraduate year 1 or 2 (55.5%). The median CIPS score at the beginning of the academic year was 68 (IQR=17, Q1=60, Q3=77) and clinically significant CIPS scores were observed throughout the academic year with 78.6% of all CIPS scores > 60. Higher CIPS scores were documented in January, February, and May compared to the beginning of the academic year in July, but not in clinically meaningful magnitudes (January: $\beta = 4.69$, CI: 0.82, 8.55; p=0.018, February: $\beta = 4.53$, CI: 1.44, 7.63; p=0.004, May: $\beta = 4.73$, CI: 1.47, 7.99; p=0.005).

Conclusion: Postgraduate medical trainees demonstrate persistent and clinically significant impostor phenomenon throughout the academic year. Supports to address the impostor phenomenon should be consistently available throughout the year.

Le syndrome de l'imposteur persistant et cliniquement significatif chez les étudiants en formation médicale postdoctorale

Résumé

Contexte : Le syndrome de l'imposteur est fréquent chez les étudiants en médecine et affecte leur bien-être ainsi que leur développement professionnel. On ignore encore comment il évolue au cours de l'année universitaire.

Méthodes : Il s'agit d'une étude prospective à mesures répétées menée auprès d'étudiants en formation médicale postdoctorale à l'Université de Toronto, réalisée entre le 4 janvier 2022 et le 30 janvier 2024. Le syndrome de l'imposteur a été évalué à l'aide du *Clance Imposter Phenomenon Scale (CIPS).* Des scores CIPS compris entre 61 et 80 reflètent un syndrome de l'imposteur cliniquement significatif, tandis que des scores supérieurs à 80 indiquent un syndrome de l'imposteur sévère. Dans cette étude, nous avons considéré qu'un écart de 20 points était cliniquement significatif. Les participants ont rempli le questionnaire CIPS toutes les 12 semaines pendant 52 semaines. Une régression par modèle à effets mixtes a été utilisée pour tester l'association entre le score CIPS et la période de l'année.

Résultats : 110 participants (taux de réponse de 14,8 %) avec un total de 406 scores CIPS ont été inclus dans l'analyse. Les participants étaient principalement âgés de 25 à 30 ans (72,7 %), étaient des résidents en médecine interne (45,5 %) et se trouvaient en première ou deuxième année de formation postdoctorale (55,5 %). Le score CIPS médian au début de l'année universitaire était de 68 (EIQ = 17, Q1 = 60, Q3 = 77) et des scores CIPS cliniquement significatifs ont été observés tout au long de l'année universitaire; 78,6 % de tous les scores CIPS étant supérieurs à 60. Des scores CIPS plus élevés ont été enregistrés en janvier, février et mai par rapport au début de l'année universitaire en juillet, mais pas dans des proportions cliniquement significatives (janvier : β = 4,69, IC : 0,82, 8,55 ; p = 0,018, février : β = 4,53, IC : 1,44, 7,63 ; p = 0,004, mai : β = 4,73, IC : 1,47, 7,99 ; p = 0,005).

Conclusion : Les étudiants en formation médicale postdoctorale présentent un syndrome de l'imposteur persistant et cliniquement significatif tout au long de l'année universitaire. Un soutien visant à lutter contre ce phénomène devrait être disponible de manière constante tout au long de l'année.

Introduction

The impostor phenomenon refers to intrinsic feelings of self-doubt and fraudulence in one's own abilities and achievements, despite the presence of external evidence to suggest otherwise.[1–5] This manifests as an inability to internalize personal successes, instead attributing them to external factors, such as luck or error.[6,7] Harbouring these feelings of inadequacy can challenge one's ability to be resilient and impede the achievement of career-related goals, while also contributing to stress, burnout, and mental illness, including increased depression, anxiety, and suicide.[4,7]

Within the medical field, impostor phenomenon is not uncommon, affecting learners and physicians at all stages and in a variety of disciplines.[4,6] Reviews have reported a prevalence of impostor phenomenon in medical students between 22-60%.[8,9] Among medical students who endorse feelings of impostorism, a majority experience it to a "frequent" or "intense" degree involving themes of perfectionism, self-criticism, social anxiety, and fears of failure and negative evaluation.[10] In postgraduate medical trainees, impostor phenomenon has a reported prevalence ranging from 33-44%, and is experienced as feelings of inadequacy and frequent comparisons with others, particularly during transitions and in hierarchical environments.[8–10] Importantly, while there has been a rise in research exploring the impostor phenomenon in medicine that has enhanced the current understanding of this construct, most studies have used cross-sectional designs.[11,12] This reflects a shortage of longitudinal data, a limitation that has been highlighted by several researchers.[9,11,12] Of the few studies that used a prospective design, none were in the medical field, which represents a significant gap in the literature.

In addition to its high prevalence in the medical field, impostor phenomenon is associated with burnout, resilience, and perceived stress.[13] Burnout refers to a psychological syndrome of emotional exhaustion, depersonalization, and reduced personal accomplishment that is highly prevalent at all stages and specialties of medicine.[9,14-18] Resilience, which is often viewed as protective against burnout, is the ability to cope with stress and thrive when faced with adversity.[1,8] The associations between impostor phenomenon and high burnout, high stress, and lower resilience are well-established, with literature to support that they may be outcomes of impostorism.[1,2,9-12,19] However, how these three constructs could be modifiers of the impostor phenomenon over time is unknown. As such, this represents another important area within the impostor phenomenon literature that warrants additional study.

Given the depth and breadth with which the impostor phenomenon impacts medical education and practice, identifying ways to address it has emerged as a research priority.[20] Interventions to address the impostor phenomenon have ranged from fostering safe, inclusive, and supportive learning and clinical environments to more formalized interventions such as workshops involving self-reflection, group-guided exercises, and humanities-based activities.[21–26] However, while many methods have been proposed to address the impostor phenomenon, a barrier to implementation is determining *when* to intervene and what other mental health strains, like stress, burnout, or resilience, should be considered in these interventions. While only a few studies have examined the relationship between impostor phenomenon and level of medical training, with most finding no association, trends in impostor phenomenon at different points of the academic year is not yet understood.[9] We suggest that by identifying potential high-risk periods, academic programs may be better equipped to designate resources during times of greatest risk, particularly in programs with limited resources.

This study aimed to answer the question: Is the time of the academic year associated with severity in impostor phenomenon as measured by the validated and widely used Clance Impostor Phenomenon Scale (CIPS) in postgraduate medical trainees at the University of Toronto? Secondly, we aimed to answer: Do burnout, resilience, and stress modify the relationship between academic year and symptoms of impostor phenomenon? We hypothesized that symptoms of impostor phenomenon are highest at times of academic transition to the next stage of training (i.e., the first month of the academic year, commonly known as rotation "Block 1"). This relationship may vary in magnitude based on factors like gender, visible minority status, stage in training, training program/speciality, caregiver status, and number of call shifts in the preceding month. We hypothesized that impostor phenomenon would be highest during Block 1, as it represents a major transition period characterized by new responsibilities, unfamiliar expectations, and heightened performance scrutiny, such as the transition from medical student to resident or from junior to senior res--dent. We further hypothesized that impostor phe--omenon would decrease over the academic year as trainees gain experience, competence, and greater

role familiarity, with Block 1 serving as the reference point for comparison. Furthermore, we hypothesized that severe burnout, low resilience, and high stress increase the severity of the impostor phenomenon over time.

Methods

Study design and setting

This was a prospective cohort study among postgraduate medical trainees at the University of Toronto (U of T). Participants were recruited from five academic centers affiliated with the University of Toronto. Participants were recruited between January 4, 2022 – January 5, 2023. This study used rolling monthly recruitment and followed each participant for a maximum of 12 months or until the end of the study (January 30, 2024). This meant that new participants were invited to participate every month, while previously recruited participants provided follow up data. Participants completed repeated outcome measurements every three academic blocks, making this an unbalanced fixed interval repeated measures study. Academic blocks are four weeks long and the academic year starts on the first working day in July every year. The blocks are numbered consecutively from 1 to 13. See Table S1 in the supplementary for a schedule of measurement occasions. Outcomes were measured using an electronic survey. The protocol for this study was published on ClinicalTrials.gov prior to recruitment and analysis (NCT05230030).

Participants

Postgraduate medical trainees at the U of T were recruited for this study using departmental email lists from the Department of Medicine and it's subspeciality programs. Participants were also recruited from study advertisement sessions and word of mouth. Advertisement sessions were conducted on the first day of neurology rotations across all sites at the U of T where neurology rotations are offered (authors of this work are in the Department of Neurology, therefore this was a convenient additional sampling strategy). Of note, although most eligible participants were from the Department of Medicine, other specialities (e.g., surgery, emergency medicine, psychiatry, family medicine) rotate through the Department of Medicine, therefore a small group from those specialities were also eligible. To be included in this study, participants were required to have active registration with the U of T Postgraduate Medical Education office. They could be at any stage of residency training (including fellowship). At the time of this study, to our knowledge there was no standardized education being delivered to trainees about impostor phenomenon through the Department of Medicine or postgraduate medical education program.

Data collection

Study data were collected and managed using Research Electronic Data Capture (REDCap) hosted at U of T. REDCap is a secure, web-based software platform designed to support data capture for research studies.[27,28]

At the time of recruitment, participants were presented with a Quick Response (QR) code, which would link them to the consent and baseline REDCap survey. After completion of the baseline survey, participants were automatically invited by REDCap to repeat the survey every three months for a total of 12 months or until the study period was over. To remind participants of subsequent surveys every three months, reminder emails were sent at 24 hours, 48 hours, and 72 hours. Participants received subsequent surveys even if they did not complete a previous survey. Participants were entered into a raffle for a 1 in 4 chance to win a $50 gift card each time they completed a survey. A notable protocol amendment (see S2 in the supplementary), in response to an unforeseen obstacle, was having REDCap send additional invitations to complete the survey to enrolled participants on June 9, 2023 and July 5, 2023. These were time periods of particular interest (block 13 and block 1) for the hypothesis which, due to rolling recruitment and schedule of repeated measurements, were not well powered. In these invitations, it specified that the first 30 participants completing surveys at these time points would be given $5 gift certificates. All recruitment,

surveys, and study related material was communicated in English, the required language of study at our institution.

Baseline characteristics

Age, gender, identification as a visible minority, caregiver status, training program, postgraduate level of training, and average number of call shifts in the prior month were self-reported in the baseline survey (see case report form in supplementary S3). For all baseline characteristics, participants had the option to prefer not to answer or skip. Caregiver status, postgraduate year, and average number of call shifts in the prior month were time-varying variables and therefore also collected in the subsequent surveys. Of note, due to a technical error, in the first 11 months of the study, gender was not collected. For participants who participated in the first 11 months, gender was collected in subsequent surveys sent out as part of their scheduled follow up measurement occasions.

Variables & outcomes

The independent variable in our primary analysis was time of academic year, denoted with block number (1-13), treated as a categorical variable. As mentioned above, the academic year is divided in thirteen 4-week blocks where the first block starts on the first working day in July. The blocks are consecutively numbered from 1 to 13 (see S1 for specific block dates in this study). Each completed survey was associated with the corresponding block number within which it was completed. Name of the academic center was not collected to minimize the potential for trainees to be inadvertently identified by study investigators,

The dependent variable (primary analysis outcome) for this study was impostor phenomenon severity as measured by repeated measures of the Clance Impostor Phenomenon Scale (CIPS). CIPS is a 20-item scale designed to measure key attributes of the impostor phenomenon including: (1) fear of evaluation, (2) fear of not being able to repeat success, and (3) fear of being less capable than others. Each item is graded on a scale ranging from 1 (*not at all true*) to 5 (*very true*), with item scores being aggregated into a total score, and higher total scores suggesting greater impostor phenomenon.[14-17] The outcome is a score between 5-100 where higher scores indicate more intense symptoms of impostor phenomenon. The scale has been validated for use in non-clinical and clinical populations, as well as among professional learners in education and leadership positions.[29–31] Scores of less than or equal to 40 reflect a low severity of impostor phenomenon symptoms, scores of 41-60 reflect a moderate severity of impostor phenomenon symptoms, and scores of greater than 60 reflect clinically significant impostor phenomenon symptoms with >80 categorized as severe. Although a minimally clinically important difference (MCID) has not been clearly established, based on the categorization detailed above of low, clinically significant, and severe symptoms, 20 points was used for the MCID in the sample size calculation below and interpretation of results.

Perceived stress, resilience, and burnout were other variables of interest in our secondary analyses. These constructs were measured by the following validated scales: Perceived Stress Scale (PSS), Connor-Davidson Resilience Scale (CD-RISC-10), and Maslach Burnout Inventory-Human Services Survey-2 for Medical Personnel (MBI-HSS MP-2).[32–34] The PSS is a 10-item questionnaire with scores ranging from 0-40, where higher scores indicated greater stress. The CD-RISC-10 is a 10-item questionnaire with scores ranging from 0-40, where higher scores indicate greater resilience. The MBI-HSS MP-2 is a 2-item questionnaire with scores on each question ranging from 0-6, where a score of 3 or more on either question indicates presence of burnout using the summative scoring rule.[34]

Analysis

Statistical analyses were performed using R statistical software version 4.2.1.[35] Rms and lme4 packages were used.[36,37] Descriptive statistics are reported with standard deviations (SD), interquartile ranges (IQR), and maximum and minimum values, as appropriate. Normality was assessed using QQ plots.

Primary analysis

The primary analysis used mixed effect regression to test the relationship between block number and CIPS. To make the most of available CIPS scores, primary analysis was conducted first with an unadjusted model (block number and CIPS score) with a random intercept. Next, it was decided a priori that an adjusted model for the primary analysis would fit baseline age, gender, caregiver status, postgraduate year, training program/specialty, identification as a visible minority, number of call shifts, and months in study as possible confounders with fixed effects and a random intercept using available data. Number of call shifts, caregiver status, postgraduate year, and months in study were time-varying covariates. We chose these covariates based on theoretical knowledge of how they may affect CIPS scores. For example, training program/speciality was important to include in the model because some training programs are shorter than others, and these differential durations may impact when and how severely impostor phenomenon is experienced. In this model, where covariate values were missing, the observation for that measurement occasion was omitted (listwise deletion). The estimates for the fixed effects are reported with 95% confidence intervals (CI) and p-values.

Secondary analysis

The secondary analysis tested if stress, resilience, and burnout modified the relationship between the time of academic year (block) and the impostor phenomenon. Three different models were made using the same adjusted model as above, except with measurements of stress, resilience, and burnout each fit as an interaction term to test effect modification, respectively, which were also time varying. Relationships were visualized using locally Estimated Scatterplot Smoothing (loess) regression lines.

Sensitivity analysis

Proportions of missing data are reported. Complete case analyses and single imputation of the worst-case/best-case scenario were performed to explore how sensitive our models were to missing data. These methods were chosen as simple, transparent, and informative methods for exploring the impact of missing data.[38] For complete case analysis, the adjusted models used only data from participants who had no missing CIPS observations (i.e., no missed study assessments or loss to follow-up). Single imputation of worst-case scenario and best-case scenario observations involved imputing missing observations at expected measurement times, with ei-ther a low CIPS score of 40 (for best-case scenario) or high CIPS score of 80 (worst-case scenario). Using the unadjusted models if the direction of the effect did not change the worst-case and best-case imputed data (i.e., positive to negative, or vice versa), the models would be considered sensitive to missing data.

Sample size

Sample size calculation using 95% confidence intervals and a power of 80% for multiple regression with eight predictors indicated approximately 83 participants were needed for this study to detect an effect size of 0.2 (20 points), which was considered the MCID for CIPS in this study.

Ethics and data sharing

All participants provided written informed consent prior to participating in the study. This study was approved by the Research Ethics Board at the U of T (REB#41967). Anonymized data will be shared upon request from qualified investigators who have appropriate data sharing agreements in place.

Results

Of the 744 postgraduate medical trainees invited with departmental emails and information sessions, 14.8% (n = 110) responded. Most participants were between 25 and 30 years old (72.7%, n = 80) and almost half identified as a visible minority (49.1%, n = 54). A significant proportion of gender data was missing (30.9%, n = 34; due to technical error) but at least half of the participants (50.0%, n = 55) reported

female gender. Most participants were junior postgraduate medical trainees (PGY1 or 2) (55.5%, n = 61) and from internal medicine subspecialties (44.5%, n = 49). Few were caregivers (10.0%, n = 11). Baseline characteristics of participants are summarized in Table 1.

Table 1. Baseline characteristics

Characteristic	All subjects (N = 110)
Age, n (%)	
20-24 years	3 (2.7)
25-30 years	80 (72.7)
31-35 years	19 (17.3)
36-40 years	6 (5.5)
>40 years	1 (0.9)
Missing	1 (0.9)
Gender, n (%)	
Female	55 (50.0)
Male	21 (19.1)
Missing	34 (30.9)
Identifies as a visible minority, n (%)	54 (49.1)
Missing	3 (2.7)
Identifies as a caregiver, n (%)	11 (10.0)
For children	8 (7.2)
For adults (ex. elderly parent, disabled relative)	3 (2.7)
Postgraduate year (PGY), n (%)	
Junior (PGY 1 or 2)	61 (55.5)
Senior (PGY 3 or 4)	35 (31.8)
PGY 5 or above (including fellows)	13 (11.8)
Missing	1 (0.9)
Training program, n (%)	
Internal medicine	50 (45.5)
Psychiatry	11 (10.0)
Family medicine	6 (5.5)
Surgery	1 (0.9)
Other*	40 (36.8)
Missing	2 (1.8)
Number of monthly call shifts, median (interquartile range)	4 (2-5)

**Other specialities included: anesthesia, emergency medicine, genetics, ophthalmology, palliative medicine, pediatric neurology, and physiatry*

CIPS scores were normally distributed. The median CIPS score at the beginning of the academic year (block 1, July) was 68 (IQR=17, Q1=60, Q3=77) while the mean was 69.2 (SD=11.7, minimum 49.0, maximum 93.0). Mean CIPS scores were observed to be clinically significant (>60) during each of the thirteen blocks where 78.6% of scores (n = 319) were reported in the severe range (>80) while only 20.7% of scores (n = 84) were 61-80, and only 0.7% (n = 3) in the low range (<61) (Figure 1). In our sample, 90.9% of all participants (n = 100) reported at least one severe CIPS score (>80) and 100% (n = 110) reported at least one clinically significant (>60) CIPS score over the course of their participation in the study.

A total of 406 repeated observations of CIPS scores were available and used for the primary analysis with the unadjusted model. A total of 317 repeated observations of CIPS scores were available and used for the primary analysis adjusted model. A total of 276 (40.5%) observations CIPS score were lost to attrition and imputed during sensitivity analyses. Figure S4 in the supplementary material details when participants were recruited, participant flow, and the number of observations each participating individual contributed to the analysis and how many were imputed in sensitivity analyses.

Primary analysis

Coefficients, confidence intervals, and p values for primary analysis are summarized in Table 2. In the unadjusted model, there were no clinically significant relationships observed between block number and CIPS score, although statistically significant higher CIPS scores were observed in blocks 8 (January), 9 (February), and 12 (May) relative to block 1. In the adjusted model, there were also no clinically significant relationships between block number and CIPS score although statistically significant higher CIPS scores were observed in block 6 (November/December) relative to block 1. Coefficients for both models are detailed in Table 2.

Table 2. Coefficients from the unadjusted and adjusted models for block number and Clance Impostor Phenomenon Scale (CIPS) scores with 95% confidence intervals

	Unadjusted model			Adjusted model		
Predictors	Estimate (β)	95% CI	P value	Estimate (β)	95% CI	P value
Intercept	69.04	66.19 – 71.90	<0.001	66.56	59.72 – 73.41	<0.001
Block [reference = 1]	--	--	--	--	--	--
Block [2]	2.04	-1.38 – 5.46	0.242	2.44	-1.32 – 6.21	0.203
Block [3]	-1.33	-5.72 – 3.07	0.553	2.38	-2.44 – 7.20	0.333

Block [4]	-1.02	-4.61 – 2.57	0.576	-1.51	-5.56 – 2.53	0.462
Block [5]	-0.35	-4.56 – 3.86	0.869	0.98	-3.75 – 5.71	0.684
Block [6]	3.27	-0.65 – 7.18	0.102	5.11	0.76 – 9.45	0.022
Block [7]	-0.29	-4.13 – 3.55	0.882	1.02	-2.98 – 5.01	0.617
Block [8]	4.69	0.82 – 8.55	0.018	4.04	-0.20 – 8.29	0.062
Block [9]	4.53	1.44 – 7.63	0.004	3.44	-0.05 – 6.92	0.054
Block [10]	0.74	-3.07 – 4.55	0.702	1.89	-2.04 – 5.81	0.345
Block [11]	1.32	-2.57 – 5.21	0.506	2.51	-1.74 – 6.76	0.246
Block [12]	4.73	1.47 – 7.99	0.005	3.34	-0.41 – 7.08	0.081
Block [13]	0.27	-2.56 – 3.09	0.852	1.5	-1.51 – 4.51	0.329
Months in study				-0.14	-0.33 – 0.05	0.146
Age [reference = 25-30 years]				--	--	--
20-24 years				3.4	-12.42 – 19.22	0.673
31-35 years				0.55	-5.32 – 6.41	0.854
36-40 years				2.07	-8.09 – 12.23	0.689
>40 years				5.34	-14.81 – 25.48	0.603
Gender [Female]				3.03	-2.56 – 8.61	0.287
Visible Minority [Yes]				5.19	0.24 – 10.15	0.040
Postgraduate year (PGY) [reference = Junior PGY 1 or 2]				--	--	--
Senior trainee (PGY 3 or 4)				-1.27	-4.14 – 1.60	0.385
PGY 5 or above (including fellows)				-0.72	-5.37 – 3.94	0.762
Training program [reference = internal medicine]				--	--	--
Surgery				4.13	-7.07 – 15.33	0.469
Family medicine				-7.37	-17.14 – 2.39	0.138
Psychiatry				-2.69	-10.51 – 5.14	0.5
Other				0.17	-3.75 – 4.09	0.932
Caregiver [Yes]				-3.17	-8.18 – 1.85	0.215
Number of call shifts in the preceding months				-0.1	-0.49 – 0.30	0.631

Secondary analysis

Figures 2-4 illustrate the frequency of burnout and levels of stress and resilience in our sample over the course of the academic year. When testing presence or absence of burnout, severity of stress, and levels of resilience as interaction terms in the multivariable models, there was no statistically significant or clinically meaningful evidence that burnout, stress, or resilience modify the relationship between time of academic year (block) and CIPS score. Coefficients, confidence intervals, and p values for secondary analyses are summarized in S5

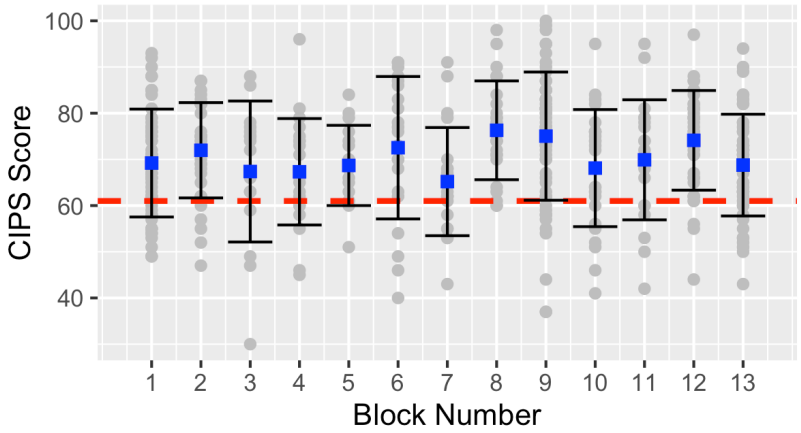

Figure 1. Clance Impostor Phenomenon Scale (CIPS) scores over the course of the academic year from all participants.
Grey circles indicate all observed CIPS scores. Blue squares indicate the mean CIPS score at each block. The black error bars indicate the standard deviation at each block. A larger CIPS score indicates more severe symptoms of impostor phenomenon where the CIPS score ranges from 5-100. The red dashed line indicates the threshold for clinically significant impostor phenomenon symptoms at greater than 60 points.

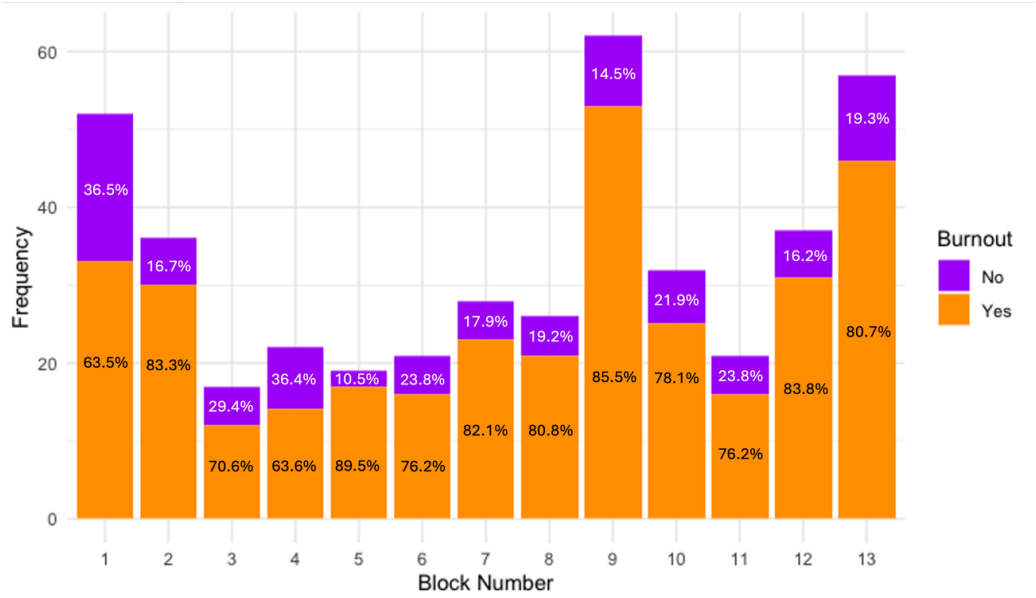

Figure 2 Frequency of burnout over the course of the academic year from all participants using the Maslach Burnout Inventory-Human Services Survey -2 for Medical Personnel (MBI-HSS MP-2).
Bars indicate all observed burnout measured by the MBI-HSS MP-2 in all participants in each block. Presence of burnout is indicated in orange and absence in purple.

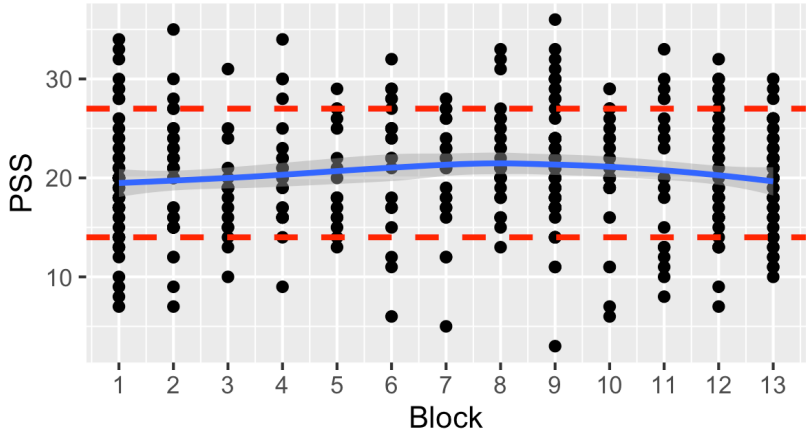

Figure 3. Levels of stress over the course of the academic year from all participants using the Perceived Stress Scale (PSS)
Black circles indicate all observed PSS scores. The blue line is the Locally Estimated Scatterplot Smoothing (loess) regression line. A larger PSS score indicates more severe stress. The PSS scale ranges from 0-40. The red dashed lines indicate the thresholds for low stress (<14), moderate stress (14-26), and high stress (>26).

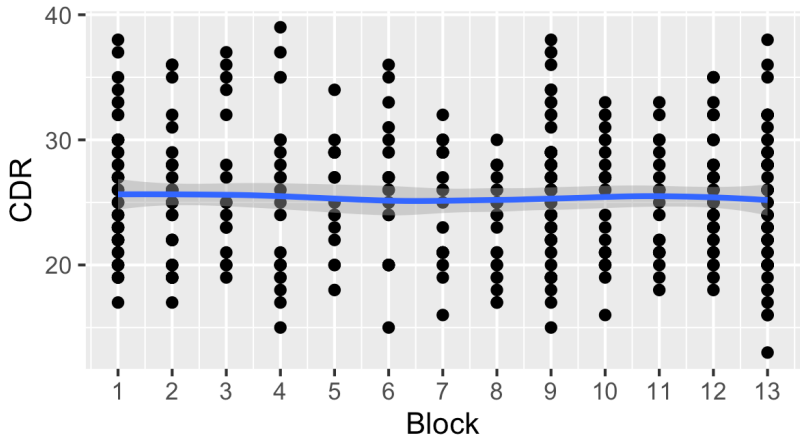

Figure 4. Levels of resilience over the course of the academic year from all participants using the Connor-Davidson Resilience Scale (CD-RISC-10)
Black circles indicate all observed CDR scores. The blue line is the Locally Estimated Scatterplot Smoothing (loess) regression line. A larger CDR score indicates greater resilience. The CDR score ranges from 0-40.

Sensitivity analyses

Number of cases and observations used in each analysis are reported in S4. Complete case analysis was consistent with the primary analysis. Regarding worst case single imputation, the direction of effect for blocks 2-13 compared to block 1 did change (mostly negative) however the estimates remained clinically insignificant in magnitude. In contrast, best-case scenario imputation demonstrated the same direction of estimates (almost all positive). Overall, these results suggest our models sensitive to missing data (from lost to follow up). Coefficients, confidence intervals, and p values for sensitivity analyses are summarized in the supplementary (S6).

Discussion

In this sample of postgraduate medical trainees, we observed clinically significant severe and persistent levels of impostor phenomenon. We show, independent of age, gender, visible minority status, caregiver status, training level, training program, and number of call shifts, our sample of postgraduate trainees experience clinically significant symptoms of impostor phenomenon throughout the academic year. Additionally, we found no evidence that stress, burnout, and resilience modify patterns of impostor phenomenon throughout the academic year. Our findings argue that specific attention to impostor phenomenon (as opposed to attention to just stress, resilience, and burnout) should be provided consistently throughout the academic year and to a large population of postgraduate trainees.

Our study demonstrates a significantly higher frequency of clinically significant and severe impostor phenomenon compared to previous studies.[39–42] To our knowledge, this is the first study investigating impostor phenomenon with repeated measures in a multidisciplinary sample of postgraduate medical trainees. A scoping review from 2019 reported four cross-sectional studies in postgraduate medical trainees using the CIPS.[8] These studies reported between 48 and 185 participants from single training programs and reported between 33% and 44% of postgraduate trainees with clinically significant impostor phenomenon symptoms (CIPS > 60).[39–42] In our study, we report substantially higher rates of impostor phenomenon with almost the entire sample reporting at least one occasion with severe CIPS.

We speculate that the increased rates of severe CIPS compared to other populations could be explained by repercussions of the COVID-19 pandemic on medical education. In Canada, 74% of a sample of medical students reported reduction in the quality

of their education since COVID-19 with similar reports in post-graduate medical education.[43] This highlights the need to evaluate the quality and access to pre-pandemic standards of medical education.

It is possible that the increased awareness and decreased stigma about the impostor phenomenon may have contributed to the higher observed rates of the impostor phenomenon in our population, as compared to previous studies.[39–42] Although there is no standardized curriculum for impostor phenomenon at the University of Toronto, it is an issue of increasing focus in our medical education programs. In the same scoping review mentioned above, a substantial increase in publications about impostor phenomenon in medical education is reported between 2016 and 2019, suggesting an increase in awareness and interest in the medical community.[8] In a more recent mixed-methods study by Chodoff et al., 57% of postgraduate trainees in their sample reported severe CIPS scores.[6] Chodoff et al recruited 28 postgraduate trainees for one-on-one interviews as informants to describe their experiences of impostor phenomenon during residency training, suggesting an eagerness to discuss this topic. Given our significant repeated response rate, we speculate a similar eagerness in participants in our study to share their experience. However, it is also possible that our rates of severe impostor phenomenon have been inflated due to self-selection bias into our study as individuals may have disproportionate experiences with impostor phenomenon and therefore a disproportionate willingness to participate and report symptoms

Our study demonstrates that severity impostor phenomenon symptoms do not vary over the course of the academic year in a clinically significant way. This was contrary to our hypothesis, and previous suggestions in the literature, that symptoms of impostor phenomenon would be highest near the transition between academic years when medical training hierarchy and responsibilities often change.[4,8–10] Our sensitivity analyses support that, even considering our unbalanced design with participants lost to follow-up and who entered the study at different times, impostor phenomenon is severe and persistent in our sample. While recognizing "Block 1" marks an important transition from one recognized level of training and associated skill set to another, severe imposter phenomenon remained persistent past this period of relative transition. To our knowledge, the longitudinal nature of severe impostor phenomenon has not been shown in prior studies in medical trainees. This new finding is important to inform medical education strategies that symptoms of impostor phenomenon (and related topics like confidence and autonomy) need to be evaluated and supported throughout the academic year and not just at transitional periods between academic years. Programs designed to address health concepts such as impostor phenomenon, stress, burnout, and resilience need to be cognizant of the pervasive, severe levels of impostor phenomenon among trainees and consider continuous, open-ended wellness programs that may allow for trainees to check-in throughout the year. Accordingly, medical education should prioritize the development and implementation of interventions that target the impostor phenomenon in both formal and informal curricula to mitigate its well-documented effects on trainee mental health.[4,8,8–10] However, given the statistical significantly higher CIPS scores observed in blocks 6,8,9 (which correspond to just before the winter holiday and the 8 weeks after), and 12 (May – June), it may be prudent in resource-constrained centres to target these time periods with interventions. As discussed in the introduction, such strategies include informal methods such as fostering safe, inclusive, and supportive learning and clinical environments, as well as more formal interventions such as workshops involving self-reflection, group-guided exercises, and humanities-based activities.[21–26]

Stress, burnout, and resilience are common topics of interest for support and intervention when navigating medical trainee wellness and have been of particular interest since the COVID-19 pandemic.[44] Previous studies have shown varied associations with these concepts and the impostor phenomenon, emphasizing the need to explore these relationships further and longitudinally.[8] Our study highlighted the high frequency of burnout, reported between 63.5% and 89.5%, and moderate levels of stress with

moderate resilience but no relationship with CIPS over time. We suspect these relationships were not observed, simply because of how high and persistent impostor phenomenon was all year. To put it bluntly, the levels are so high that it just can't get worse even with additional stressors such as burnout and stress, or it can't get better even with increased resilience. Overall, these results highlight that although burnout, stress, and resilience are important aspects of postgraduate medical trainee wellness, support and interventions targeted at these concepts are not likely to impact severity of impostor phenomenon over time. This emphasizes the need for medical education to develop and assess of specific interventions for impostor phenomenon.

A limitation of our study is that we did not assess whether participants had received prior education about the impostor phenomenon, either before or during the study. Another limitation is that we did not collect information on which academic centre they were training at during the study, which could have been a factor on their exposure to impostor phenomenon education and support. Nonetheless, we made significant efforts to recruit broadly, ensure anonymity, and provide a small token of recognition to encourage unbiased recruitment.

Conclusions

We found that symptoms of impostor phenomenon are frequent, severe, and persistent in this population of postgraduate medical trainees over the course of an academic year. Future studies evaluating longitudinal implications and interventions for these frequent, severe, and persistent symptoms will be important to foster impactful and sustainable postgraduate medical education.

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