


Why Do We Feel Like Intellectual Frauds? A Self-Determination Theory Perspective on the Impostor Phenomenon in Medical Students

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ABSTRACT

Theory: Impostor phenomenon (IP) refers to people's feelings of intellectual fraudulence and fear of being "discovered," despite contradicting evidence of success. Due to its association with burnout and distress, it is progressively being studied in medicine. While various explanations for IP have been discussed in the literature, the role of motivation has largely been neglected. **Hypotheses:** Using self-determination theory (SDT) as a lens, it was hypothesized that different general causality orientations (impersonal, control, autonomy), domain-specific types of motivation (autonomous vs. controlled) toward going to medical school, and levels of satisfaction of basic psychological needs (autonomy, competence, relatedness) in the medical program, would each predict severity of IP symptoms. **Method:** A total of 1,450 medical students from three Canadian institutions were invited to complete a survey containing the Clance Impostor Phenomenon Scale and scales derived from SDT's mini theories: basic psychological needs theory, causality orientations theory, and organismic integration theory. We explored the prevalence of IP among the students and used regression to capture variable relationships, accounting for gender effects. **Results:** Data from 277 (19.1%) students were assessed, 73% of whom reported moderate or worse IP symptoms. Having an impersonal general causality orientation, more controlled motivation toward going to medical school, and lower need satisfaction in the medical program, each related to increased IP severity. Together, these motivational factors accounted for 30.3%, 13.6%, and 21.8% of the variance in students' IP severity, respectively. **Conclusions:** Findings from this study suggest that students who are more self-determined (both in general and in medical school), and whose basic psychological needs are more supported in their medical program, will experience less frequent and severe IP symptoms. Preliminary explanations and implications of these findings are discussed within the medical education context.

Abbreviations: AM: autonomous motivation; ANOVA: analysis of variance; BPNS-W: basic psychological need satisfaction at work scale; BPNT: basic psychological needs theory; CIPS: Clance impostor phenomenon scale; CM: controlled motivation; COT: causality orientations theory; C-RAI: comprehensive relative autonomy index; GCOS: general causality orientations scale; IP: impostor phenomenon; OIT: organismic integration theory; SDT: self-determination theory

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Introduction

The negative impact of the "impostor phenomenon" (IP) is increasingly being recognized in medicine, due to its troubling association with distress and burnout.¹ While various explanations for IP have been discussed in the literature, few have moved beyond individual or environmental factors that relate to it—neglecting their dynamic interaction. As some authors have speculated,² empirical evidence suggests that self-determination theory's (SDT) framework,³ which accounts for

simultaneous consideration of individual and environmental factors, may be useful in this context—to better understand IP and its motivational underpinnings.

In the first description of IP, Clance & Imes alluded to the role of motivation, describing those who suffered from IP as "highly persistent and successful against the odds...because of their powerful need to prove themselves and society wrong."^{4(p244)} They added that these individuals would "attempt to avoid these feelings and prevent the discovery of their impostorism by working extra hard, which pays off in excellent

performances and approval from authorities.”^{4(p244)} From a SDT perspective, these thoughts and actions resemble not only controlling forms of behavior regulation but deprivation of basic psychological needs—each of which SDT considers unstable for self-esteem and wellness.³ The present study tests this theory in a medical education context and proposes a novel explanation for IP, based on SDT and several of its mini theories: basic psychological needs theory (BPNT), causality orientations theory (COT), and organismic integration theory (OIT).

Impostor phenomenon (IP)

According to Clance and Imes,⁴ IP is characterized by three main features: discounting achievement, attributing success to luck, and feeling like a fake. Despite being successful by all objective standards, “impostors” distrust their abilities and feel like intellectual frauds, secretly fearing exposure. Imaginary as these perceptions may be, their negative consequences are very real. Studies have linked IP to lower job satisfaction,⁵ work-related burnout,⁶ anxiety and depression,⁷ and higher risk for suicide.⁸ While IP is known to impact many populations,^{9–11} it appears to have a particular affinity for high-achieving individuals, in academics and professionals.^{4,12} Research concerning IP has therefore increased in the health professions and education fields.^{1,13,14}

IP in medicine

According to a recent scoping review, up to 60% or more of physicians and medical trainees are affected by IP.¹ Studies also show that IP occurs not only during career transitions,¹⁵ but across the entire span of one’s medical training and practice.^{16–18} As others have highlighted, this is considered highly problematic for the medical profession, given that its high demands and “workaholic” culture already threaten the well-being of healthcare workers.^{1,19} With the profound impact that burnout and distress have on those in the medical field, a better understanding of IP’s etiology (and ways to address it) is of clear and timely importance.^{20–23}

In medical students in particular, IP has been associated with low self-esteem,²⁴ perfectionism,²⁵ burnout,²⁶ and other mental health problems.²⁷ The prevalence of IP and influence of various sociodemographic factors (e.g., gender) have also been investigated.^{28–30} Interestingly, some studies suggest that IP disproportionately affects females^{17,26} while others

report no gender differences.^{24,30,31} IP has also been found to be more prevalent among ethnic minority students,^{15,26,29} though this too is inconsistently reported in and outside of medicine.^{28,30,31} Together, these studies imply a dynamic interplay between individual and environment, in which motivational (e.g., internalization) processes appear likely to be at play.

IP and motivation

In our review of the literature, we identified a handful of studies exploring relationships between motivation and IP. Motivation is defined here as the underlying cause for a person’s goal pursuits.³² In this line of research, IP has been associated with achievement motivation,³³ the need for approval,²⁵ and the desire to appear smart.³⁴ Others have linked it to motivational processes involving professional identity formation,^{10,35,36} self-verification,³⁷ and self-esteem fragility, in which “impostors” relentlessly strive for achievement as a compensatory mechanism to convince others (and thus themselves) of their intellect.³⁸ Research has also uncovered links between IP and achievement pressure,³⁹ hyper-competitiveness,⁴⁰ and perfectionism,⁴¹ and that individuals will enact repeated efforts to “break the cycle” of their impostor feelings.¹⁰ Especially relevant to the present investigation was a study of women in higher education which found that different attributions (e.g., to ability) and levels of workplace need satisfaction influenced IP experiences.⁴²

In medicine, we could identify only one pertinent study concerning IP and motivation, in which LaDonna et al.¹⁸ interviewed physicians about their experiences with failure. They found that many physicians had recurrent feelings of impostorism in their careers, and that these perceptions would intensify in clinical situations involving observers, because it would trigger fraudulent feelings about the illustrious white coat and façade of having to model doctor-like behaviors.¹⁸ While these reactions may not appear to reflect motivation—at least on the surface—when the same physicians were asked how they viewed and responded to their impostor feelings, some claimed that it humbled them and thereby served as motivation.¹⁸

Put together, substantial empirical evidence supports a connection between human motivation and IP. However, several ostensibly valuable questions remain unanswered in the literature—namely, does the quality (i.e., type) of one’s motivation impact how frequently and severely one experiences IP, and if so, how does the social context influence that process? As SDT concerns itself with different types

of motivation and their unique effects on human behavior and well-being, it is well-suited to help answer these questions.

Self-determination theory (SDT)

SDT³ is a leading macro theory of motivation, development, and well-being. It assumes that people universally require ongoing satisfaction of three psychological needs to grow and function optimally: autonomy (sense of personal volition), competence (sense of efficacy), and relatedness (sense of connectedness).³ According to SDT and its mini theory, basic psychological needs theory (BPNT), environments which support these “basic needs” will yield more self-determined forms of motivation that promote self-actualization and wellness, while environments that thwart them will yield the opposite effect.³ SDT therefore specifies various types of motivation that exist along an autonomy-control continuum, ranging from fully externally controlled to fully internally motivated.⁴³ For a review of literature from the broader health professions education context, dealing with types of motivation and basic needs, see Orsini *et al.*^{44,45}

While SDT argues that basic needs are innate, it also acknowledges that they can be developed in social contexts, leading to individual differences (i.e., that cut across domains and times) in how people orient toward environments and regulate behavior.³ Causality orientations theory (COT) describes these differences in three distinct motivational orientations: impersonal, control, and autonomy.⁴⁶ “Autonomous” individuals tend to orient toward environments out of interest—seeing possibilities for choices and self-regulation; “controlled” individuals tend to orient toward rewards, gains, and approval; and “impersonal” individuals tend to orient toward the obstacles preventing their goal attainment. These orientations are thought to co-exist within all individuals to various degrees and affect their situational motivation, behavior, and wellness.⁴⁶

Organismic integration theory (OIT)³ focuses on extrinsic motivation (behavior that is instrumental or aimed beyond the specific activity itself). OIT identifies four distinct subtypes of extrinsic motivation, based on degree of internalization (i.e., relative autonomy): external (acting for the sake of incentives or punishments without internalizing anything), introjection (behaving based on partially internalized goals or regulations that are not accepted as one’s own, which leads to contingencies of self-esteem), identification (a more internalized regulation, leading to behavior that is based on personal importance or

value), and integration (doing something because it has been fully internalized and assimilated into one’s core sense of self). Hence, OIT posits that more internalized behavior regulations will correspond with a more internal perceived locus of causality (how much one feels their actions are driven by internal vs. external forces) and a greater sense of autonomy when enacting the specific behavior.⁴⁷

Together, these SDT mini theories explain that autonomous individuals will tend to use the identified and integrated styles of behavior regulation, controlled individuals will tend to use the external and introjected styles, and impersonal individuals will tend to be more amotivated.³ Importantly, SDT highlights that need satisfaction is what ultimately facilitates internalization (and therefore self-determination). Accordingly, we reasoned that in seeking to internalize and integrate what they associate with becoming successful medical doctors (which requires performing many different tasks that are challenging and not necessarily interesting or optional), medical students could differ in their adjustment (and thus IP symptoms) in medical school, depending on their general causality orientation, endorsement of autonomous vs. controlled motivation toward going to medical school, and level of need satisfaction in the medical program.

Current study

Although IP has widely been theorized to reflect a person’s inability to internalize achievements, no studies have used SDT’s internalization framework to investigate this. Further, while it follows that IP would reflect levels of need satisfaction—with attributing success to luck (autonomy), discounting achievement (competence), and feeling like a fake (relatedness)—only one published study has looked at this in higher education.⁴² These investigations seem highly relevant in medicine, where demanding environments can foster controlled motivation,^{48–50} self-doubt, and feelings of inadequacy.¹⁸ The present study addresses this gap in the literature by exploring how three conceptually related but distinct aspects of motivation, described by SDT (general causality orientations, relative autonomy, and basic psychological need satisfaction), impact the severity of IP among medical students. It also assesses the prevalence of IP among the students and whether its intensity varies by gender and ethnic minority status.

Based on the IP literature, we hypothesized that a) female vs. male medical students and ethnic minority vs. non-minority medical students would each report

more severe IP symptoms. Then, because it is SDT's view that different types of general causality orientations tend to correspond with distinct types of behavior regulations and levels of need satisfaction, we hypothesized that b) the autonomy general causality orientation would be associated with higher relative autonomy toward going to medical school, higher need satisfaction in the medical program, and less severe IP symptoms; and c) the control and impersonal general causality orientations would be associated with lower relative autonomy toward going to medical school, less need satisfaction in the medical program, and more severe IP symptoms. Finally, we theorized that d) competence satisfaction would contribute most to the variance in students' IP symptom severity, over and above their needs for autonomy and relatedness.

Method

Procedure

A total of 1,450 medical students from three Canadian Universities (Saskatchewan, Alberta, and Calgary), in all years of training, were invited to complete a voluntary online survey (see Measures). Invitations were sent via email, newsletter, and learning portals, and students received two monthly reminders. To maintain confidentiality and minimize response bias, surveys were completely anonymous. Students were informed about the nature of the study and freely consented to take part. This study was approved by the Human Research Ethics Boards of the Universities of Saskatchewan (#1817), Alberta (#103116), and Calgary (#20-1687).

Participants

A total of 315 (21.7%) medical students participated in this study: 131/400 (32.7%) from the University of Saskatchewan, 133/600 (22.2%) from the University of Alberta, and 51/450 (11.3%) from the University of Calgary. However, 38 surveys were excluded from analysis due to being under 50% complete, which left a total of 277 (19.1%) full responses. See Table 1 for further sample characteristics, based on each institution.

Measures

The electronic survey contained demographic questions about gender identity ("male," "female," or "other") and whether students identified as ethnic (i.e., non-white) minorities ("yes" or "no"). We did not collect further details than this, to keep the survey

manageable for students and to promote a higher response rate, given the potentially sensitive and identifying nature of the information. Students then completed four measurement instruments (described below). Consent was obtained to use the CIPS;⁵¹ the SDT scales are freely available for use online.

General Causality Orientations Scale (GCOS)

The original GCOS measures the strength of three distinct motivational orientations within an individual: impersonal, control, and autonomy. It is validated in multiple samples of university students and has been used in various populations and cultures with satisfactory reliability estimates.⁴⁶ The GCOS consists of 12 vignettes—each with three behavioral options to rate (corresponding to the three subscales), based on a scale from 1 (*very unlikely*) to 7 (*very likely*). An example vignette is: "You have been offered a new position in a company, where you have worked for some time. The first question that is likely to come to mind is..." a) *What if I can't live up to the new responsibility?* (impersonal), b) *Will I make more at this position?* (control), and c) *I wonder if the new work will be interesting* (autonomy). We computed mean total scores for each subscale, where higher scores indicate a relatively stronger general causality orientation.

Comprehensive Relative Autonomy Index (C-RAI)

This 24-item scale measures the type of a person's motivation for engaging in some behavior (e.g., exercising), along the autonomy-control continuum.⁴³ It has been validated in samples of U.S. and Russian university students with high reliability across studies.^{43,52,53} In the current study, the C-RAI was used to assess students' motivation toward going to medical school. Students answered questions about why they go to medical school on a scale from 1 (*not true at all*) to 7 (*very true*). The C-RAI has two main subscales (controlled and autonomous), and students get a score on each. Examples of controlled items were: "I used to know why I was going to medical school, but I don't anymore" (amotivated), "because I don't have any choice in going to medical school" (external), and "because I would feel guilty if I didn't go to medical school" (negative introjection). Examples of autonomous items were: "because I want to feel proud of myself" (positive introjection), "because I strongly value going to medical school" (identified), and "because I enjoy going to medical school" (intrinsic). We computed mean total scores for the two main subscales, where higher scores indicate higher motivation of that type.

Table 1. Sample characteristics based on medical institution.

	University of Saskatchewan <i>n</i> = 111	University of Alberta <i>n</i> = 117	University of Calgary <i>n</i> = 49
Gender			
Male	39 (35.1%)	52 (44.4%)	8 (16.3%)
Female	72 (64.9%)	65 (55.6%)	41 (83.7%)
Ethnic minority	30 (27.0%)	32 (27.4%)	18 (36.7%)
Program year			
Year 1	60 (54.1%)	42 (35.9%)	22 (44.9%)
Year 2	17 (15.3%)	27 (23.1%)	9 (18.4%)
Year 3	18 (16.2%)	26 (23.4%)	16 (32.7%)
Year 4	17 (15.3%)	23 (19.7%)	N/A*

All data and percentages represent total frequency.

*The medical program at the University of Calgary is 3 years long, inclusive of summers.

Basic Psychological Need Satisfaction at Work Scale (BPNS-W)

This 21-item scale measures the degree to which people perceive their needs for autonomy, competence, and relatedness are satisfied in their workplace. It has been validated and widely used among different cultures and populations with high reliability values, including academics, learners, employees, and supervisors.^{54–56} We adapted the wording of the scale to reflect the “school” or “work” (instead of “job”) context so that it would apply to all medical students, regardless of whether they functioned primarily in pre-clinical (“school”) or clinical (“work”) environments. Participants responded to items on a scale from 1 (*not true at all*) to 7 (*very true*). Example items were: “*I feel like I can pretty much be myself at school/work*” (autonomy), “*people at school/work tell me I am good at what I do*” (competence), and “*my feelings are taken into consideration at school/work*” (relatedness). We calculated mean total scores for each basic need subscale, where higher scores indicate higher need satisfaction.

Clance Impostor Phenomenon Scale (CIPS)

The CIPS is a 20-item scale which measures whether individuals have impostor characteristics, and if so, to what extent they are affected in their lives.⁵¹ It has previously been validated and shown to have a stable three-factor structure (fake, luck, discount).⁵⁷ The CIPS is among the most used measures of IP due to its brevity and strong psychometric properties, with good reliability estimates reported across multiple studies of university and medical students.⁵⁸ Unlike other measures of IP, the CIPS accounts for people’s fears of evaluation and feeling less capable than others, which we consider particularly germane to medical students. Participants rate each CIPS item on a scale from 1 (*not true at all*) to 5 (*very true*). The higher the CIPS mean score, the more frequently and severely it interferes in one’s life (symptom scores of

40 or lower indicate mild, 41–60 indicate moderate, 61–80 indicate severe, and 80 or higher indicate intense). We used the conservative cutoff score of 62 to determine the prevalence of “impostors” in the sample, and the total sample mean CIPS score as the outcome variable in all other analyses.⁵⁹ Several examples of CIPS items were: “*I can give the impression that I’m more competent than I really am*” (fake), “*At times, I feel my success has been due to some kind of luck*” (luck), and “*I often compare my ability to those around me and think they may be more intelligent than I am*” (discount).

Statistical analyses

The software SPSS version 25.0 (SPSS Inc, Chicago, IL) was used for our analyses. We calculated a minimum requirement of 220 participants based on the rule of having at least 20 observations per predictor variable.⁶⁰ The sample size in the present study was therefore considered adequate for statistical power. All variables were standardized and determined to be normally distributed. Internal consistency (Cronbach’s alpha) coefficients were computed for each scale (see Table 3) and were found to be acceptable, except for the control GCOS subscale which was borderline acceptable.⁶¹ Descriptive statistics included prevalence of IP characteristics with a breakdown by students’ gender and ethnic minority status. One-way analysis of variance (ANOVA) was used to test for mean differences in IP severity (based on CIPS total scores) by gender and ethnic minority status. A chi-square test of independence was used to determine whether the categorical distribution of IP severity scores varied based on gender. For post-hoc tests, 95% confidence intervals and Bonferroni *p*-value correction for multiple comparisons were used, along with Cohen’s *d* standardized effect sizes (where *d* = 0.2, 0.5, and 0.8 are considered small, medium, and large, respectively). Variable relationships were then assessed with Pearson correlation and linear regression, testing the effects

Table 2. Total sample and gender subgroup characteristics.

	All <i>n</i> = 277	Males <i>n</i> = 99	Females <i>n</i> = 178
Ethnic minority	80 (28.9%)	26 (26.3%)	54 (30.3%)
CIPS severity			
Mild	8 (2.9%)	5 (5.1%)	3 (1.7%)
Moderate	59 (21.3%)	29 (29.3%)	30 (16.9%)
Severe	147 (53.1%)	48 (48.5%)	99 (55.6%)
Intense	63 (22.7%)	17 (17.2%)	46 (25.8%)

All data and percentages represent total frequency.

Table 3. Descriptives of and correlations between study variables.

Variables	1	2	3	4	5	6	7	8	9
1. IMP	(.75)								
2. CON	.25**	(.64)							
3. AUT	-.24**	.04	(.80)						
4. CM	.44**	.19**	-.36**	(.93)					
5. AM	-.07	-.23**	.44**	-.30**	(.88)				
6. ASAT	-.29**	.01	.35**	-.45**	.48**	(.78)			
7. CSAT	-.44**	.08	.34**	-.49**	.51**	.66**	(.74)		
8. RSAT	-.36**	-.08	.42**	-.41**	.47**	.60**	.59**	(.89)	
9. IP	.50**	-.04	-.01	.30**	-.03	-.31**	-.40**	-.18**	(.90)
Mean	46.7	43.8	68.5	24.5	63.3	27.8	27.9	39.3	70.0
SD	10.5	8.3	8.4	14.4	12.9	7.3	5.9	9.2	13.6
Range	17–77	22–68	33–84	12–81	15–84	7–47	7–41	8–56	33–96

IMP, impersonal; CON, control; AUT, autonomy; CM, controlled motivation (amotivated, extrinsic, negative introjection); AM, autonomous motivation (positive introjection, identified, intrinsic); ASAT, autonomy satisfaction; CSAT, competence satisfaction; RSAT, relatedness satisfaction; IP, impostor phenomenon; SD, standard deviation; Cronbach's alphas along the diagonal.

** $p < .01$.

of general causality orientation, relative autonomy toward going to medical school, and need satisfaction in the medical program, on students' IP severity. To avoid issues of collinearity, each subset of predictor variables was assessed separately, adjusting for significant demographic effects based on ANOVA results.

Results

Sample characteristics and demographic factors

We first determined the prevalence of IP within the sample. Based on the CIPS criteria (see Measures), this was 204/277 (73.3%). Further sample characteristics are summarized in Table 2. We then explored whether IP severity varied by students' gender and ethnic minority status. The male and female students had unequal variances in their IP characteristics, based on Levene's test ($p = .02$). Thus, we performed a one-way ANOVA with Welch's correction. This analysis revealed a medium effect of gender ($d = .42$) where females ($M = 72.1$; $SD = 12.5$) scored significantly higher than males ($M = 66.3$; $SD = 14.8$) on overall IP severity ($F_{\text{Welch}}(1, 174.03) = 10.78$, $p = .001$). A chi-square test revealed that the distribution of IP severity categories varied significantly based on gender ($X^2(3) = 10.58$, $p = .01$). The ethnic minority ($M = 70.8$; $SD = 14.7$) vs. non-minority ($M = 69.7$; $SD = 13.2$) subgroups had equal variances in their IP characteristics, based on Levene's test ($p > .05$).

However, students' ethnic minority status was not a significant factor in their IP severity ($F(1, 273) = .413$, $p = .521$).

Relationships between motivation and IP

Table 3 shows the means, standard deviations, ranges, and intercorrelations for the main study variables. Correlational findings indicated that the impersonal general causality orientation positively related to IP severity, while the control and autonomy general causality orientations were not significant correlates of IP severity. Controlled motivation toward going to medical school positively related to IP severity, while autonomous motivation toward going to medical school did not relate to IP severity. Lastly, satisfaction of each basic psychological need—autonomy, competence, and relatedness—negatively related to IP severity.

Table 4 shows the main findings based on our hypothesized variable relationships. In the first step, we found a positive association between the impersonal general causality orientation and IP severity, but no significant relationship between the control or autonomy general causality orientations and IP severity. In the second step, we found a positive association between controlled motivation toward going to medical school and IP severity, but no significant association between autonomous motivation and IP severity.

Table 4. Results of simple regressions for motivational variables predicting medical students' impostor characteristics (controlling for gender).

Variables	<i>B</i>	<i>SE. B</i>	β
General causality orientation			
Impersonal	.615	.069	.493**
Control	-.018	.101	-.012
Autonomy	-.016	.099	-.010
$R^2 = .303$			
$F(4, 237) = 25.78, p < .001$			
Domain specific motivation			
Controlled	.297	.053	.319**
Autonomous	-.050	.063	-.048
$R^2 = .136$			
$F(3, 264) = 13.87, p < .001$			
Psychological need satisfaction			
Autonomy	-.573	.109	-.312**
Competence	-.936	.129	-.493**
Relatedness	-.277	.089	-.193*
$R^2 = .218$			
$F(4, 246) = 17.10, p < .001$			

B, unstandardized regression coefficient; *SE. B*, standard error of *B*; β , standardized regression coefficient.

* $p < .01$, ** $p < .001$.

In the third step, we found a negative association between autonomy, competence, and relatedness satisfaction in the medical program and IP severity. Together, the students' general causality orientations, relative autonomy toward going to medical school, and need satisfaction in the medical program, accounted for 30.3%, 13.6%, and 21.8% of the variance in the severity of their IP symptoms, respectively.

To further explore some of the above findings, we examined how controlled (CM) and autonomous motivation (AM) might vary at different levels of IP severity (moderate, severe, and intense). The mild category of IP symptoms was excluded from this analysis because there were only eight students in this category and the cutoff score for being an "impostor" fell within the moderate level of symptoms. As shown in Figure 1, we found that on average AM remained stable while CM increased across IP severity levels. Independent *t*-tests indicated that the increase in CM was significant with each level increase in IP symptom severity: from moderate to severe ($t(132) = 3.19, p = .001$) and from severe to intense ($t(81) = 3.09, p = .003$). The effect sizes associated with each of these tests was $d = 0.47$ and $d = 0.51$, respectively, which are both considered medium.

Discussion

In the present study, SDT was introduced and conceptually applied to the issue of IP among a sample of medical students from three large Canadian institutions. Theorized motivational mechanisms for IP were then described and investigated in terms of students' general causality orientation, relative autonomy toward going to medical school, and need satisfaction

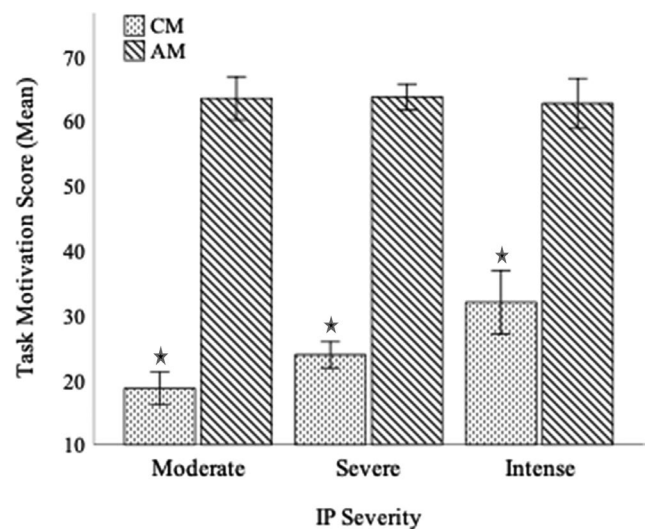


Figure 1. Controlled (CM) vs. autonomous (AM) motivation at different levels of IP severity. Task motivation represents the mean total scores for controlled (amotivated, external, negative introjection) vs. autonomous (positive introjection, identified, intrinsic) motivation toward going to medical school, based on the C-RAI. Error bars represent 95% confidence intervals. Asterisks represent significant *t*-scores of CM at each level increase in IP severity, based on the CIPS.

in their medical program. Findings and their potential implications in medical education are discussed below, with preliminary suggestions for researchers and educators.

In assessing the prevalence of IP in the sample, most (approximately 75%) of the students met the CIPS criteria for being "impostors," based on the conservative cutoff score.⁵⁹ Of further concern was the fact that over 50% of the students met not only the minimum "impostor" criteria, but reported frequent and severe symptoms. In fact, 25% reported IP

symptoms at the intense level, which are considered extremely bothersome in one's life.⁵¹ These findings align with other studies describing the prevalence and severity of IP in medical learners.^{1,14,24,29,30} In light of the risks that IP poses to medical students' self-esteem,^{24,62} mental health,^{26,27} and intentions to continue in their medical training,³⁰ these findings are alarming.

Another important finding is that females reported suffering more from IP than males, and the distribution of IP severity scores varied significantly by gender. While the medical literature is mixed regarding gender differences in IP, other studies have also reported this result.^{16,26,63} The present study did not explore why gender differences might exist in IP characteristics, but studies suggest that it may pertain to variations in how IP manifests. For instance, female medical students have been shown to respond more strongly to CIPS items involving "comparing self to others" and "unfounded worry about succeeding," while male students responded more strongly to CIPS items involving "failure avoidance."^{15,64} Finally, reasons for the lack of hypothesized association between ethnic minority status and IP severity in this study, while in line with some literature,¹⁵ remain unknown. It may reflect the fact that under 30% of students in this study identified as minorities, and/or the approach that we used, which did not capture unique effects of various ethnicities.

Regarding students' motivation, we found that the majority oriented more toward the autonomy general causality orientation than the control or impersonal orientations. In keeping with SDT's view, this was further reflected in students' endorsement of autonomous vs. controlled motivation toward going to medical school, and their need satisfaction in the medical program. The students' need satisfaction scores also indicate that they felt a greater sense of relatedness than autonomy and competence (both roughly 35% lower) in the medical program. This could be because medical schools tend to facilitate friendships that promote social support, during an otherwise rigorous and tightly scheduled curriculum that could hinder students' sense of agency and self-efficacy.⁶⁵

General causality orientations and IP

As we hypothesized, general causality orientation was a strong predictor of students' IP severity. However, we were surprised to find that only the impersonal orientation was predictive of this outcome. This may be explained by the fact that the impersonal orientation

is associated with lower self-esteem, higher performance anxiety, and having negative self-evaluations.^{46,66} These aspects overlap with Clance & Imes'⁴ definition of IP. In the context of medical training, strong pulls to conform, immense pressures to be successful, and many stressful challenges can threaten students' well-being and sense of self-worth.^{67,68} Thus, impersonal medical students—who by default are more likely to be vulnerable to stress incursion and feelings of helplessness—may simply be more prone to feelings of not belonging, or in other words, that they are "impostors."

With respect to the null association between the control and autonomy orientations and IP severity, there are several plausible reasons. First, controlled individuals tend to be driven toward external praises and away from criticisms.⁴⁶ However, there is no evidence linking the control orientation to negative or positive self-evaluations, and both controlled and autonomous students tend to be more confident in their academic abilities than impersonal students.⁶⁹ Secondly, the autonomy orientation is associated with higher self-esteem and awareness, a healthier approach to achievement, and a tendency to attribute success to ability and effort,^{46,66,70–72} which is the opposite to what "impostors" believe.⁴ That said, COT posits that autonomy and control orientations should comprise an internal locus of control (belief of having self-control over the outcomes in one's life) while the impersonal orientation should comprise one that is external (belief that factors such as fate or luck have more influence).⁴⁶ These differences might explain why the autonomy and control orientations did not relate to IP severity. Whether these two general causality orientations play a greater role in shaping how adaptively one responds to IP is a subject for future research.

Domain-specific motivation and IP

We observed that controlled motivation toward going to medical school significantly impacted IP severity, suggesting that students who better internalize why they are going to medical school will experience less severe IP as a result. This is likely because individuals with controlled (amotivated, external, and negative introjected) regulatory styles tend to adopt performance goals (e.g., avoiding the appearance of incompetence), which leads them to persist in a pressured way that is devoid of interest, joy, and self-determination.^{69,73,74} In contrast, individuals whose regulatory styles are more autonomous (identified, integrated, and intrinsic) tend to adopt mastery goals (e.g., truly understanding the learning material), which leads them to embrace

different strategies that bolster resilience and persistence, regardless of success or failure.^{69,73,74} Our finding that students' autonomous motivation toward going to medical school remained stable, while their controlled motivation increased with IP severity (see Figure 1), supports this OIT perspective.

Basic psychological needs and IP

As we hypothesized, students' need satisfaction in the medical program was a significant predictor of their IP severity. This association suggests that when students sense more autonomy, relatedness, and especially competence, in their medical program, they will likely suffer from less frequent and severe IP symptoms. These findings align with BPNT and compliment other studies in the health and medical education literature, showing that lower need satisfaction is associated with poorer academic engagement and performance, lower resilience and psychological well-being, and higher levels of burnout,^{44,75,76} factors that have now all been linked to IP.^{1,19,77}

In view of these findings, learners who suffer from IP will likely benefit from more autonomy-supportive learning environments. For medical educators, it means emphasizing mastery over performance goals (i.e., a "growth" mindset)^{78,79}—particularly since IP manifests in medical students largely as discounting successes, comparison of their performance to others, and fear of failure (which all suggest a "fixed" mindset).¹⁵ This approach would help learners to better internalize their successes by shifting their perceived locus of causality from impersonal and external to internal. Unfortunately, when high performances are perceived as the "gold standard," intrinsic motivation to learn will inevitably be replaced by pressures that impede this process.⁸⁰

Our findings also highlight the importance of creating a culture that fosters psychological safety for medical students.^{18,81,82} This notion has practical implications for group discussions and wellness curricula in medicine, which could focus on de-stigmatizing IP and helping students to recognize and respond adaptively to it.¹ Social support like this would foster all three of medical students' basic psychological needs—relatedness in particular. For a review of strategies that educators and administrators can use to foster these needs for medical students, see here.^{50,83–85}

Limitations and future directions

This study has several limitations which may help guide future research. First, the data were from self-report measures collected via surveys, and there

was a relatively low response rate. Having said that, the present study's response rate is consistent with those reported in survey studies in the health professions.⁸⁶ Female and first-year students were also over-represented in this study, and there were more participants from two institutions than the third. Additionally, we conducted a fair number of analyses, which increases the risk for Type 1 error, even with a Bonferroni correction. These limitations reduce the generalizability of our findings. The binary approach we took to determining the students' ethnicity status (i.e., minority or not) also represents a weakness: while it helped with group sizes, it failed to account for any unique effects of ethnicities and how those medical students might experience IP. Future studies on ethnic differences in IP may therefore consider this aspect.

Another set of limitations relate to the scales we used. We measured students' need satisfaction (but not frustration) in their medical program. Considering that need frustration does not equate to a lack of need satisfaction,⁸⁷ future studies are warranted to assess both need satisfaction and need frustration in relation to IP. Next, the C-RAI is useful for measuring any abstraction of motivated behavior, but we did not specify how every regulation contributed to students' IP severity. While including the GCOS makes up for that to an extent, it too has limitations. The original GCOS is an older scale based on general situations and not specific domains (e.g., the workplace), which has received some criticism in the SDT community.⁸⁸ Relatedly, its control subscale in the present study had marginally acceptable reliability, although it was comparable in size to that in the original validation of the GCOS.⁴⁶ Future studies may therefore consider a more specific version of the GCOS and/or employ multidimensional modeling with the C-RAI (e.g., cluster analysis⁸⁹ or latent profile analysis⁹⁰), which could provide more differentiated descriptions of each regulation and their unique effects on IP severity.

Clance⁵¹ also defines IP based on three main features, and validation studies support a three-factor structure for the CIPS.⁵⁷ However, the CIPS is most commonly used and interpreted based on a total CIPS score (as in the present study), rather than individual subscale scores.⁵⁸ While this approach provides a useful means to determine the presence and severity of impostor characteristics, it does not capture IP's multidimensional nuances. Future studies may therefore consider a more in-depth analysis of how different types of motivation might impact IP in medical students. Interpretation of the CIPS also appears to vary considerably in IP literature, with some studies using

the same IP criteria as the present study,⁵⁹ and other studies using lower mean or median CIPS scores.⁹¹ This seems to reflect concerns about differences between the CIPS and other impostor scales.^{14,58} Hence, the CIPS may be the most popular IP scale, but further studies are warranted to validate and assess its dimensionality in medical education (i.e., what criteria are best and whether permutations of IP exist that the CIPS fails to capture).⁵⁸

We attempted to mitigate these study limitations by using well-established measurement instruments, collecting data from multiple sources (i.e., institutions), and employing statistical tests that did not rely on sample size or equal variances, wherever necessary. We were also reassured to observe that after accounting for minor operational differences (e.g., reporting total vs. average scores), the present study's need satisfaction scores were similar to those reported in other studies in the health professions and medical education literature.^{45,92} This suggests that non-response bias is less likely to be a limitation, and supports the convergent validity and generalizability of our findings. We nonetheless consider this study to be preliminary and recommend adaptation of it at other medical institutions, including the use of other robust research methods that can extend our hypotheses and findings.

Conclusions

This study advances the discussion on the etiology of IP by uncovering several of its motivational underpinnings. Findings are consistent with SDT's organismic-dialectical viewpoint and suggest that medical students who are more self-determined (both in general and in medical school), and whose basic psychological needs (for autonomy, competence, and relatedness) are more supported in their medical program, will experience less frequent and severe IP symptoms. As such, this study provides new directions for research on IP, along with new theoretical ideas about how it can be understood and addressed in medical education and beyond.

Data availability

The data from the present study can be made available upon reasonable request.

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