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Not all 'impostors' are created equal: A dimensional, person-centered, and theory-based analysis of medical students

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ABSTRACT

Purpose: Research on the impostor phenomenon (IP) is rapidly growing in medical education due to its relationship with distress and burnout. How IP is theoretically conceptualized and analyzed has been inconsistent, however, which limits our understanding of results and how to act on them. We hypothesized that a person-centered analysis, in combination with a robust theoretical framework, would provide a more specific 'profile' of medical student IP and help to optimize supports for their well-being.

Materials & methods: We used exploratory factor analysis to assess the factor structure of the Clance Impostor Phenomenon Scale (CIPS) in medical students, followed by cluster analysis to identify distinct 'impostor' profiles, based on the identified factors. We then used self-determination theory's (SDT) framework of motivation to explore how students in each profile differed in their general causality orientation, autonomous motivation towards going to medical school, and psychological need satisfaction in the medical program – factors that SDT identifies as predictors of engagement, performance, and well-being.

Results: Factor analysis yielded three main IP factors – feeling like a fake, attributing success to luck, and discounting achievement – in line with Clance's original definition of IP. The cluster analysis then identified four distinct IP profiles based on individual differences in these factors, each varying in aspects of their self-determination.

Conclusions: This study sheds light on the ways that medical students may experience IP, further reinforcing the notion that not all 'impostors' are created equal. Findings support the three-factor structure of the CIPS among medical students, and that most students will fall into one of four IP profiles. These profiles and their implications are discussed.

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Introduction

Medical students are at high risk for psychological distress and burnout, and the impostor phenomenon (IP) has been identified as a strong contributor (Henning et al. 1998; Gottlieb et al. 2020). IP is therefore critical to address in undergraduate medical education. That said, inconsistencies exist in how IP is being conceptualized and analyzed in the literature, which problematizes results and their interpretation. Furthermore, it is important to consider not only the severity of IP symptoms (i.e. from mild to intense), but also different and potentially less evident types of IP. Such new considerations and kinds of analyses, combined with theory-driven approaches, can help inform the conversation on IP and its unique effects on medical students. Given IP has a motivational/behavioural aspect to it, the present study employs self-determination theory's (SDT) motivation framework to explain the nature of IP patterns and guide supports for medical student well-being, based on students' specific needs.

Practice points

- Factor analysis yielded three main IP factors among medical students – feeling like a fake, attributing success to luck, and discounting achievement – in line with Clance's original definition of IP.
- The cluster analysis then identified four distinct IP profiles based on individual differences in these factors – disbelievers, total impostors, fakers, and discounters – each varying in aspects of their self-determination.
- Findings reinforce the notion that not all 'impostors' are created equal, and suggest that describing IP profiles and their implications can be helpful for medical students, in terms of supporting their motivation and psychological well-being.

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Impostor phenomenon

First conceptualized by Clance and Imes (1978), IP is thought to reflect self-doubt (feeling like a fake and having intense fears of evaluation), the belief that one's success is due to luck (discounting of achievements), and poor internalization of achievements (perpetually needing to prove oneself and seek external approval) (Cozzarelli and Major 1990; O'Brien McElwee and Yurak 2010). IP is highly prevalent in competitive educational programs such as science, technology, engineering, and mathematics (STEM), and medicine (Henning et al. 1998; Lee et al. 2022). Research on IP has therefore been expanding in these fields (Gottlieb et al. 2020).

IP dimensionality

Different scales exist for measuring IP characteristics; however, the Clance Impostor Phenomenon Scale (CIPS) is the most common and widely accepted (Mak et al. 2019). Published studies on the construct validity of the CIPS support three distinct IP factors – fake, luck, and discount – as per Clance and Imes' original definition (Chrisman et al. 1995). Yet, in various populations, the CIPS dimensionality has ranged from one to three factors, and many studies have used a single continuous CIPS score (Mak et al. 2019). These differences make results difficult to interpret and compare across studies, highlighting the need for further research on the factor structure of the CIPS (Lee et al. 2022).

Different types of IP

Research suggests that different people also experience IP differently – for example, based on whether performance evaluations occur in private vs. public settings (Leary et al. 2000). Leonhardt et al. (2017) used cluster analysis and grouped various professionals based on their CIPS total scores. They found that two groups existed: one with negative self-evaluations, dysfunctional perfectionism, and negative emotions (the so-called 'true' impostors), and another with positive self-evaluations and emotions, and less dysfunctional behaviours (the so-called 'strategic' impostors). While a theoretical framework was not used, to Leonhardt et al. (2017), the differences implied that the 'strategic' impostors were portraying themselves negatively to others as a self-handicapping mechanism. These two groups did not actually differ in their total CIPS scores, which demonstrates the value of evaluating the factor structure of the scale first.

In STEM and medicine, studies support the possibility of different types of IP. For instance, Lee et al. (2022) did a factor analysis of the CIPS, using a sample of graduate students, and found three main factors, with the defining feature being fear. The authors then used cluster analysis and found that different groups existed based on students' self-evaluations. Research has also shown that medical students differ in their susceptibility to IP based on demographic factors, such as educational program, gender, and ethnicity (Gottlieb et al. 2020), personality traits (Bernard et al. 2002), and, relevant for this study, self-determination (Neufeld et al. 2023).

Self-determination theory and IP

Self-determination theory (SDT) posits three basic psychological needs: autonomy, competence, and relatedness (Ryan and Deci 2017). When environments support these needs, people will experience better engagement, performance, and well-being, based on autonomous motivation, whereas when environments hinder these needs, people will experience the opposite, based on controlled motivation (Ryan and Deci 2017). While these needs are considered universal, SDT acknowledges that individual differences exist in their strength. These differences give rise to three distinct motivational orientations (i.e. general causality orientations) that exist within an individual, each varying in their level of autonomy: impersonal (when people are primed to feel amotivated, anxious, and incompetent), control (when people are primed to be motivated on the basis of external and internal pressures), and autonomy (when people are primed to be motivated based on interest and enjoyment) (Ryan and Deci 2017).

Emerging research on IP in medical education supports SDT's principles. A recent study showed that medical students' CIPS scores related to their general causality orientation, degree of autonomous vs. controlled motivation in medical school, and basic psychological need satisfaction in the medical program (Neufeld et al. 2023). These findings suggest that the frequency and severity of medical students' IP symptoms likely stem, at least in part, from hindrance of their self-determination, both at the individual (within-person) and environment (between-persons) level. Like others, however, a limitation of that study was that it used a single continuous CIPS score (Mak et al. 2019). Hence, further work is needed in order to explore different combinations of IP dimensions in relation to aspects of medical learner motivation and well-being.

Present study

The purpose of this study was threefold. We aimed to: (1) address the issue of conceptual clarity (factor structure) of IP in medical students; (2) based on the resultant factor structure, identify distinct IP patterns (profiles) among medical students; and (3) examine how each IP profile differs in demographics, general causality orientation, motivation towards going to medical school, and need satisfaction in the learning environment.

We used cluster analysis to help make a distinctive description of IP and how it might be experienced by different medical students. This is an important distinction to make since many psychological constructs are taken as black and white (they seldom are), which leads us to group students into categories based on over-simplistic notions of a trait or condition. Unlike variable-centered analyses, cluster analysis permits us to examine how variable relationships and patterns hold in different groups of individuals within the same sample. It thereby helps to provide more nuance that can inform student-centered interventions (e.g. with tailored teaching and feedback or efforts to support their well-being).

Materials & methods

Participants and procedure

All medical students from three universities in Western Canada – University of Saskatchewan, University of Alberta, and University of Calgary – were invited to participate in the study ($N = 1{,}450$ students in total) by completing an

online survey (see Measures). Invitations were circulated in student newsletters, online learning platform, and via email, with two monthly reminders. This was a general call for participants, and students were not asked to self-screen for IP in order to take part in the study. To maintain confidentiality and minimize response bias, surveys were anonymous. Students were informed about the study and freely consented to participate. The study received ethical approval from research boards at each university (UofS: #1817; UofA: #103116; UofC: #20-1687).

A total of 315 (21.7%) students responded to the survey: 131 (32.7%) from the UofS, 133 (22.2%) from the UofA, and 51 (11.3%) from the UofC. However, 38 surveys were excluded from analysis due to being under 50% complete, which left 277 (19.1%) responses. Of these, 178 (64%) students identified as cisgender women and 80 (29%) responded 'yes' to the question 'Do you consider yourself to be part of a minority ethnic group?' To minimize any potential for students to be identifiable, no other demographic questions (e.g. age) were included in the survey.

Measures

Students completed four scales (described below). Consent was obtained to use the CIPS (Clance 1985) and the SDT scales are freely available online.

Clance Impostor Phenomenon Scale (CIPS): The CIPS has 20 items and measures whether individuals have impostor characteristics, and to what extent (Clance 1985). Scores under 40 indicate mild symptoms, 41-60 indicate moderate, 61-80 indicate severe, and 80+ indicate intense symptoms. The CIPS has been used in health professions and medical education and is the most used measure of IP due to its brevity and strong psychometric properties (Mak et al. 2019). Students rated each item from 1 (*not true at all*) to 5 (*very true*), where higher scores indicate more frequent and severe IP symptoms.

General Causality Orientations Scale (GCOS): The GCOS measures the strength of three motivational orientations within an individual: impersonal, control, and autonomy. It has been used in medical education and is validated in various populations, with good reliability (Deci and Ryan 1985; Williams and Deci 1996; Neufeld et al. 2023). The GCOS consists of 12 vignettes – each with 3 behavioural options to rate, corresponding to the three orientations, based on a scale from 1 (*very unlikely*) to 7 (*very likely*). We computed mean scores for each subscale, where higher scores indicate a stronger causality orientation of that type.

Comprehensive Relative Autonomy Index (C-RAI): This 24-item scale measures the type of a person's motivation towards some behaviour on the autonomy-control continuum (Ryan and Connell 1989). It has been used in medical education and validated in university students, with high reliability (Ryan and Connell 1989; Williams et al. 1996; Neufeld et al. 2023). In this study, the C-RAI was used to assess students' motivation towards going to medical school. Students answered questions about why they do this on a scale from 1 (*not true at all*) to 7 (*very true*). The C-RAI has two main subscales – controlled and autonomous. We computed mean scores for each subscale, where higher scores indicate stronger motivation of that type.

Basic Psychological Need Satisfaction at Work Scale (BPNS-W): This 21-item scale measures the degree that people perceive their autonomy, competence, and relatedness needs are satisfied in their workplace. It has been validated and widely used, including among medical students, with high reliability (Ilardi et al. 1993; Schultz et al. 2015; Orsini et al. 2016). 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 worked primarily in pre-clinical or clinical settings. Participants responded to items on a scale from 1 (*not true at all)* to 7 (*very true*). We computed mean scores for each need subscale, with higher scores indicating greater satisfaction of that need in medical school.

Analyses

Using SPSS v. 26.0, we computed descriptive statistics and Cronbach alpha coefficients for all measures. All continuous variables were checked for distribution normality and linearity of relationships. To identify the number of factors that conceptually define the IP, we conducted an exploratory factor analysis (EFA) on the 20-item CIPS, using principal component analysis with varimax rotation. This approach was used in the validation of the CIPS (Chrisman et al. 1995) and allows us to compare the CIPS factorial structure in new settings (i.e. in medical students). We used the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity to ensure the data and sample size were sufficient (Xie and DeVellis 1992). KMO values between 0.8-1 and a significant Bartlett's test indicate sample adequacy. To evaluate factor structure, we used the criteria: factors with eigenvalues $>$ 1, conceptual clarity, interpretability, simple structure, and variance extracted from the measured items $>$ 50%. The Anderson-Rubin method was used to compute factor scores for each student (Anderson and Rubin 1956). This approach maintains orthogonality of extracted factors, where factor scores have a mean of 0 and standard deviation of 1.

We then performed a *k*-means cluster analysis on the resultant CIPS factors, to identify distinct IP clusters in the sample. For determining the optimal number of clusters, we explored a range of 0 to 10 clusters. Results were assessed by examining the cluster tendency, iteration history, and analysis of variance (ANOVA) statistics. Stability of the model was assessed by performing a double-split cross-validation procedure (Vansteenkiste et al. 2009). We used chi-square to test for cluster differences with respect to gender and ethnic minority status to determine if these demographic variables needed to be controlled for in subsequent between-cluster analyses. Controlling for significant demographic effects, we then performed three separate multivariate analyses of covariance (MANCOVA) to determine whether students in each IP cluster differed in: general causality orientation, motivation towards going to medical school, and need satisfaction in the medical program. Tukey's method was used for post-hoc pairwise comparisons, and partial eta squared (η^2) values were computed as a measure of standardized effect size of

mean differences, where 0.01, 0.06, and 0.14 are considered small, medium, and large, respectively.

Results

The results of descriptive analyses indicated that students ranged in the severity of IP symptoms (min-max scores = 33–96; mean = 70.04; SD = 13.61). Only seven students (2.5%) were identified as having mild IP symptoms. Otherwise, 21.0% of students had moderate symptoms, 53.4% had severe symptoms, and 23.1% had intense symptoms. As such, the survey data from all the students were included in the analyses.

Factor analysis

The KMO index of sampling adequacy in the current sample was .90, and the Bartlett's test for sphericity was statistically significant (χ^2 (190) = 2400.65, $p < .001$). The data thus met the requirements for factor analysis (Xie and DeVellis 1992). The EFA showed that a 3-factor structure best represented the data, explaining 50% of the variance in the CIPS items. However, some of the CIPS items loaded onto two factors. We therefore removed three items (1, 4, and 12), one by one, and re-ran the analysis. This increased the explained variance to 54%, with the remaining 17 items each loading onto one of the three CIPS factors (i.e. with no cross-loading greater than 0.4).

When looking at the items that loaded on each factor (Table 1), it appeared that factor 1 was 'fake' (10 items; 27% variance explained; Cronbach alpha = .88) and reflected self-doubt about one's ability and intelligence. Factor 2 was 'luck' (4 items; 14% variance explained; Cronbach alpha = .75) and reflected perceptions of success being due to luck. Factor 3 was 'discount' (3 items; 12% variance explained; Cronbach alpha = .60) and reflected one's predisposition to deprecate success. This 3-factor structure, observed among medical students, was consistent with Clance's conceptualization of IP and original findings, and other CIPS validation studies (Kertay et al. 1992; Chrisman et al. 1995; Brauer and Wolf 2016).

Cluster analysis

Student scores on the resultant three CIPS factors were then used in the cluster analysis. Results showed that a 4-cluster solution best fit the data, with complete convergence after 7 iterations and significant ANOVA results across the three CIPS factors: fake (F (3, 139) = 62.28, $p < .001$), luck (F (3, 139) = 43.66, $p < .001$), and discount (F (3, 139) = 48.93, $p < .001$). There were 69 students in Cluster 1 (25%), 97 in Cluster 2 (35%), 60 in Cluster 3 (22%), and 51 in Cluster 4 (18%). We conceptualized these clusters as: (1) 'disbelievers', (2) 'total impostors', (3) 'fakers', and (4) 'discounters'. Results of the double split cross-validation method produced highly similar clusters, supporting the validity and stability of the 4-cluster solution. Figure 1 shows the four clusters and their unique IP features.

Results of the chi-square tests showed that the four clusters did not differ in terms of ethnic minority status ($p > .05$) but differed significantly by gender (X^2 (3, 277) = 12.21, $p = .007$), where 70% of Cluster 1, 68% of Cluster 2, 70% of Cluster 3, and 43% of Cluster 4 students were cisgender women. We thereby proceeded with three separate MANCOVAs, using the 4-cluster solution as the independent variable and the general causality orientation, motivation towards going to medical school, and basic psychological needs as the respective dependent variables, while controlling for gender. Levene's test was significant for competence ($p < .001$) and relatedness ($p = .043$) satisfaction, and controlled motivation towards going to medical school ($p = .010$). Corrected values were therefore used to account for the inequality of error variances.

Table 1. Standardized loadings for the three-factor model of the CIPS items.

Item # and actual CIPS item	1 fake	2 luck	3 discount
14. I'm often afraid I may fail at a new assignment or undertaking, even though I generally do well at what I attempt	.810		
18. I often worry about not succeeding with a project or examination, even though others around me have considerable confidence I will do well	.794		
17. I often compare my ability to those around me and think they may be more intelligent than I am	.721		
13. Sometimes I'm afraid others will discover how much knowledge or ability I really lack	.705		
6. I'm afraid people important to me may find out that I'm not as capable as they think I am	.703		
15. When I have succeeded at something and received recognition for my accomplishments, I have doubts that I can keep repeating that success	.642		
7. I tend to remember the incidents in which I have not done my best more than those times I have done my best	.541		
20. I feel bad and discouraged if I'm not 'the best' or at least 'very special' in situations that involve achievement	.533		
3. I avoid evaluations if possible and have a dread of others evaluating me	.506		
8. I rarely do a task or project as well as I'd like to do it	.403		
11. At times, I feel my success has been due to some kind of luck		.773	
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		.760	
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		.675	
2. I can give the impression that I'm more competent than I really am		.533	
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			.712
10. It's hard for me to accept compliments or praise about my intelligence or accomplishments			.705
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			.648

Note: Items 1, 4, and 12 were excluded from in the final EFA solution.

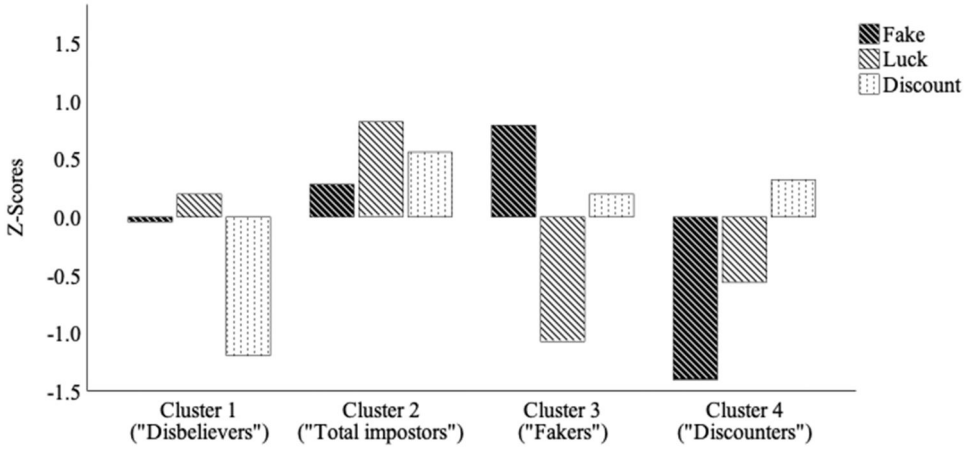

Figure 1. Medical student IP clusters based on 3-factor CIPS structure.

Between-cluster differences

The first MANCOVA tested the effect of IP cluster on the impersonal (IMP), control (CON), and autonomy (AUT) general causality orientations, while controlling for gender. The interaction of gender and IP cluster was not significant. There were significant main effects of IP cluster on IMP (F (5, 244) = 1078.51, $p < .001$, $\eta^2 = .96$), CON (F (5, 244) = 1392.21, $p < .001$, $\eta^2 = .97$, and AUT (F (5, 244) = 3419.00, $p < .001$, $\eta^2 = .99$). Tukey's post-hoc pairwise comparisons were thus performed to see where the differences lay.

With IMP, Cluster 4 ('discounters') scored the lowest and differed from Cluster 3 ('fakers') (MD = −6.00, SE = 2.08, p = .022, 95% CI: −11.39 to −0.61), Cluster 2 ('total impostors') (MD = −9.69, SE = 1.87, $p < .001$, 95% CI: −14.53 to −4.85), and marginally from Cluster 1 ('disbelievers') (MD = −5.04, SE = 1.97, p = .054, 95% CI: −10.14 to .05). The only other difference was between Clusters 1 and 2 (MD = −4.65, SE = 1.63, p = .024, 95% CI: −8.87 to −0.43). With CON, the MANCOVA found a main effect of IP cluster, but post-hoc pairwise comparisons did not reach statistical significance. With AUT, Cluster 4 had the highest mean score and differed significantly from Cluster 1, whose mean score was the lowest (MD = 5.73, SE = 1.62, p = .003, 95% CI: 1.54 to 9.93). There were no other between-cluster differences in AUT.

The second MANCOVA tested the effect of IP cluster on quality of motivation towards going to medical school – controlled (CM) and autonomous (AM) – while controlling for gender. The interaction of gender and IP cluster was not statistically significant. The MANCOVA indicated a significant main effect of IP cluster on CM (F (5, 270) = 164.88, $p < .001$, $\eta^2 = .76$) and AM (F (5, 270) = 1356.30, $p < .001$, $\eta^2 = .96$). Tukey's post-hoc pairwise comparisons were thus performed to see where the differences lay.

With CM, Cluster 2 ('total impostors') had the highest mean score and differed significantly from Cluster 4 ('discounters') (MD = 7.63, SE = 2.49, p = .013, 95% CI: 1.19 to 14.07). There were no other between-cluster differences in CM. With AM, the MANCOVA found a significant main effect of IP cluster; however, none of the post-hoc pairwise comparisons were statistically significant.

The third MANCOVA tested the effect of IP cluster on students' autonomy (ASAT), competence (CSAT), and relatedness (RSAT) satisfaction in the medical program, while controlling for gender. The interaction of gender and IP cluster was not statistically significant. The analysis indicated main effects of IP cluster on ASAT (F (4, 253) = 2.43, p = .048, $\eta^2 = .04$), CSAT (F (4, 253) = 7.84, $p < .001$, $\eta^2 = .11$), and RSAT (F (4, 253) = 2.73, p = .030, $\eta^2 = .04$). Tukey's post-hoc pairwise comparisons were again performed to see where the differences lay.

With ASAT, the one significant difference was between Cluster 2 ('total impostors') and Cluster 4 ('discounters') (MD = −4.01, SE = 1.31, p = .002, 95% CI: −6.59 to −1.44). With CSAT, Cluster 2 ('total impostors') had the lowest mean score and differed significantly from all other clusters – the 'disbelievers' in Cluster 1 (MD = −3.36, SE = .90, p = .001, 95% CI: −5.69 to −1.02), 'fakers' in Cluster 3 (MD = −3.45, SE = .97, p = .003, 95% CI: −5.96 to −0.94), and 'discounters' in Cluster 4 (MD = −4.93, SE = 1.02, $p < .001$, 95% CI: −7.56 to −2.30). There were no other significant between-cluster differences in CSAT. With RSAT, there was a marginal difference between Clusters 2 and 4, the latter having the highest mean score overall (MD = −4.24, SE = 1.66, p = .054, 95% CI: −8.54 to .05). There were no other between-cluster differences.

Discussion

In this study, we investigated the factorial structure of the CIPS in a population of medical students, identified IP profiles in this population, and examined differences in demographic and motivation variables across the IP profiles.

First, we performed factor analysis of the CIPS to provide conceptual clarity in the IP construct among medical students. Results indicated the presence of three factors (fake, luck, discount), supporting the original factor structure proposed by Clance that was also reported in studies with various populations (Clance and Imes 1978; Mak et al. 2019; Lee et al. 2022). The reliability coefficients of the three factors in our study were acceptable. The lower Cronbach alphas for 'luck' and 'discount' are likely due to the small number of items comprising these two factors.

Next, using cluster analysis, we identified four distinct IP clusters that differed significantly on the fake, luck, and discount dimensions of IP. In other words, we identified four distinct groups of students – each who felt like a fake, attributed success to luck, and discounted achievement, but to different degrees. This finding aligns with prior studies showing that individuals who experience IP are not a homogeneous group (Leonhardt et al. 2017; Lee et al. 2022). We also found support for different IP types, including medical

Table 2. Summary of the four IP profiles and their unique features in medical students.

Cluster / Profile	*n* (%) of students	Main IP characteristics	Main motivational features
1. Disbelievers	69 (25%)	–Feel that their success is primarily due to luck –Otherwise, do not feel like a fake or discount achievements	–Have a strong external locus of control (believe that their successes are primarily due to external factors, such as luck or error)
2. Total impostors	97 (35%)	–Moderate to high levels of all three dimensions of IP: • feeling like a fake • discounting their achievements • attributing success to luck	–Prone to be impersonally orientated and to experience amotivation, anxiety, and feelings of incompetence –Controllingly motivated in their medical training (based on external and internal pressures) –Sense of competence and autonomy satisfaction is low
3. Fakers	60 (22%)	–Strongly feel like a fake, with less attribution of success to luck, but moderate discounting of success –Downplay abilities out of ego-defense (to increase social acceptance and external praise)	–Higher controlled motivation, with high prevalence of introjection (internal pressure) –Lowest in competence and relatedness satisfaction; hence the need to prove themselves
4. Discounters	51 (18%)	–Discount achievements but neither feel like a fake, nor attribute success to luck –Growth (over performance) oriented, preferring to deflect attention from themselves	–Autonomously motivated, with high levels of need satisfaction –Have a strong internal perceived locus of control (belief that their success is primarily self-determined) –Discount achievement for the sake of relatedness, autonomy, and self-verification

students with true negative self-perceptions ('total impostors') and those with beliefs suggesting strategies for managing expectations of others ('fakers'). This finding reinforces what Leonhardt et al. (2017) identified as 'true' and 'strategic' impostors among professionals in leadership positions.

In the present study, the four IP clusters – disbelievers, total impostors, fakers, and discounters – differed with respect to motivation variables, with some effect sizes being large. Table 2 presents a summary of each cluster's main features and differences.

'Disbelievers' had low levels of feeling like a fake, moderate levels of attributing success to luck, and the lowest scores in discounting achievement. Of the four IP clusters, these medical students scored the lowest on the autonomy causality orientation. From a SDT perspective, this is likely because these students have an external locus of control (i.e. belief that one's success is a result of external factors, such as luck or fate) vs. an internal locus of control (i.e. belief that one's success originates from their own ability and efforts). This is why we labelled this group 'disbelievers' – based on their lack of self-belief and self-determination.

'Total impostors' – the largest of the four IP clusters – appeared to suffer the most psychologically. These students reported moderate to high scores across each of the three IP dimensions: feeling like a fake, attributing success to luck, and discounting achievement. Of the four IP clusters, this group scored the highest on the impersonal causality orientation and on controlled motivation towards going to medical school. They also had the lowest competence satisfaction in the medical program. Together, these findings suggest that, for these students, reasons for going to medical school likely stem from pressures, both external (e.g. social influence) and internal (e.g. the need to prove something to oneself), and that they tend to feel amotivated, anxious, and incompetent in their medical training.

'Fakers' appeared to have predominantly high perceptions of being a fake (i.e. doubting their intelligence and worthiness). These students did not attribute their success to luck but had a higher tendency to discount their success – a strategy that some may use to appear smart and obtain others' approval (Leonhardt et al. 2017; Lee et al. 2022). This group had only slightly lower achievement discounting but significantly lower need satisfaction than students in Cluster 4 ('discounters'). It therefore follows that 'fakers', who do not feel worthy of belonging, are discounting their achievements to convince others of their intellect ('grab' more competence) and to gain acceptance ('grab' more relatedness).

'Discounters' discounted their success but neither felt like a fake, nor attributed their success to luck. Of the four IP clusters, these students scored the lowest on the impersonal- and highest on the autonomy causality orientation. They also scored the highest on autonomy, competence, and relatedness satisfaction in medical school. They thus appeared to have the highest self-determination vs. all other IP groups. This suggests that these students are not discounting achievements to appear 'successful' or to prove anything to anyone (extrinsic), but rather because they genuinely wish to make friends and be viewed favourably by others (intrinsic). In other words, they discount achievements for relatedness and autonomy, and for self-verification (how they wish to be known by others), which reduces their feeling of being 'different'. This is in contrast to the 'fakers' whose IP and ways of coping relate more to perceived (in)competence.

Practical implications

In the present study, we identified four distinct ways that medical students might experience IP and how each group differs from a self-determination perspective. Results highlight how 'total impostors' could suffer most in the medical program, but that other groups are important not to overlook (i.e. who may appear better off but have different and potentially bothersome IP experiences too).

Using the SDT framework helped conceptualize the different IP profiles. It is important, however, not to use this information to 'diagnose' or target certain medical students, since this could stigmatize and undermine their well-being. Instead, the findings from this study help us understand that different medical students will uniquely experience IP during their medical education. This can be addressed in wellness curricula by describing the different IP profiles and that students will have different IP experiences with different implications. Programs could then consider offering strategies that medical students could use to re-frame their experiences – for instance, if they found themselves feeling

like a fake (e.g. have them reflect on successes and personal goals, and less on other students), or disbelieving their abilities (e.g. encourage growth mindset, goal setting, and focus on efforts made), or experiencing total impostorism (e.g. reflect on one's 'why' for going to medical school, goal-orientation, and challenges related to external pressures). Evidence from this and other recent studies suggests that creating learning environments that support medical students' basic psychological needs may also help reduce the severity of their IP symptoms, while promoting their self-determination at the same time (Neufeld et al. 2023).

Strengths, limitations, and future directions

This study used a moderately large sample of medical students from three Canadian universities. The medical programs in these three universities are considered representative of the programs in other Canadian universities (same admissions criteria and curricula). While we were able to collect data from medical students who were in various years of training, one program is three years in duration (i.e. no summer breaks), whereas the other two programs are four years. As such, we were unable to investigate differences in the IP profiles based on year of training. Future research is warranted in this area.

As with all convenience samples, participants were self-selected, so the sample may not be generalizable to the wider medical student population. Relatedly, we surveyed only medical students (not residents, fellows, or practicing physicians, who are also known to experience IP), and the data was self-reported, which potentiates response bias. We also collected data at only one time point. It thus remains unclear whether the IP profiles we found are enduring or stable, or whether medical students might fit into different profiles over time (i.e. as a dynamic process), depending on their stage of training and learning environment. Longitudinal studies, including learners at different stages in their medical training, are therefore recommended. Finally, despite having a reasonable number of participants in the study, the overall response rate was low, possibly due in part to the pandemic. While the response rate in the present study is consistent with survey studies in health professions education (Phillips et al. 2017), future research is needed to determine if the CIPS factorial structure in the current study holds in other samples of medical students, and if similar IP profiles are present. We attempted to mitigate these limitations by using anonymous surveys, collecting data from students at multiple universities, and using well-established scales that derive from SDT.

Conclusions

In conclusion, this study sheds light on the ways that medical students may experience IP in the medical program, further reinforcing the notion that not all 'impostors' are created equal. Findings support the three-factor structure of the CIPS among medical students, and that most students will fall into one of four IP profiles, based on their perceptions of feeling like a fake, attributing their success to luck, and discounting their achievement. The observed differences in self-determination among the four IP profiles in this study help explain the nature of each IP profile and inform supports for medical students from a motivation and well-being perspective.

Author contributions

All authors contributed to the study and read and approved the final version of the manuscript. Authors AN and OB contributed equally with the study's conception and design, statistical analyses, and writing of the initial manuscript. GM edited and provided constructive feedback through several iterations of the paper.

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The authors have no conflicts of interest to declare.

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Data availability statement

The dataset from this research is available upon reasonable request.

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