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Impostor syndrome as a driver of burnout: a Bayesian latent trait analysis among early-career researchers

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Abstract

Work-related burnout is increasingly prevalent in modern society, with certain professionals, such as academics, particularly at risk. Although adverse working conditions are often considered the primary cause, individual psychological factors may also contribute to burnout vulnerability. Impostor syndrome (IS) is a plausible candidate in academic settings because persistent self-doubt and fear of negative evaluation can intensify stress responses. This study investigates whether IS is associated with higher levels of burnout among early-career researchers, drawing on survey data from 161 respondents. Using a Bayesian Graded Response Model, we estimate the effect of IS on burnout, while controlling for confounders identified via a Directed Acyclic Graph, that is sociodemographic factors, working conditions, and individual personal beliefs. Results show that IS is linked to an increased risk of burnout. This finding highlights the importance of considering not only contextual but also individual factors to create safe and healthy working environments.

Keywords academic labor market, early-career researchers, psychological distress, impostor phenomenon, DAG.

1. Introduction

The term burnout was first used in a clinical sense in the 1970s by American psychologist Herbert Freudenberger to describe a state of mental exhaustion and depletion of psychological resources caused by chronic work-related stress (Weber and Jaekel-Reinhard 2000; Schaufeli

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2017; Jensen and Olsen 2023). While increasingly discussed as a collective experience, as suggested by Han's (2015) depiction of contemporary society as a 'burnout society', certain professional groups are considered more at risk, particularly healthcare workers and those employed in academia (Maslach et al. 2001; Ahola et al. 2014; Nagy et al. 2019; Hall 2023).

Academics operate within what has been defined a 'toxic research culture' (Hall 2023), characterized by low salaries, a pervasive publish or perish mentality, job insecurity, and complex tasks that often require individuals to suppress negative emotions and 'toughen up' (Conroy 2025). This environment forces many to live under constant and intense stress, creating ideal conditions for the development of burnout (Maslach et al. 2001; Khan et al. 2019; Dinis et al. 2024) which can affect academics regardless of seniority or research field (Hall 2023), with evidence nonetheless suggesting higher prevalence among younger generations (Jones 2022).

Recent contributions move beyond a narrow focus on the working environment and examine internal psychological mechanisms that may shape burnout, with particular emphasis on the association between burnout and Impostor Syndrome (IS) (Cawcutt et al. 2021; Ojeda 2024). IS is a condition typically observed in high-achieving individuals who, despite tangible evidence of their competence, feel like frauds and attribute their accomplishments to external factors such as luck and timing, rather than their own abilities (Clance and Imes 1978; Chrisman et al. 1995; Leary et al. 2000). This often leads to self-destructive behaviors, a pervasive fear of failure, and a tendency to catastrophize setbacks (De Vries 2005). Such patterns set off a vicious cycle: the individual feels like an impostor, overcompensates by working twice as hard to prove his/her worth, and this overexertion increases the risk of burnout.

To date, empirical studies examining this association have been largely confined to the medical profession (Legassie et al. 2008; Villwock et al. 2016; Liu et al. 2022; Türkel et al. 2025; Gisselbaek et al. 2025) and, to our knowledge, no previous research has attempted to investigate quantitatively the association between IS and burnout in academics, with existing studies being primarily qualitative in nature (e.g. Jaremka et al. 2020). Our work aims to fill this gap by examining whether IS is associated with burnout, focusing specifically on early-career researchers. We focus on early-career researchers because they represent a sensitive career stage in which professional identity and self-evaluative beliefs are still forming. Early academic careers are characterized by high evaluative pressure, career uncertainty, intense anxiety and stress conditions (Cilli et al. 2023) making this group particularly informative for testing links between IS and burnout.

To achieve our research goal, we conducted a survey of 161 early-career researchers employed in different fields of study such as agriculture, environment, food sciences, economics, and humanities. Burnout is measured via the Burnout Assessment Tool (BAT) by Schaufeli et al. (2020), while IS via the Clance Impostor Phenomenon Scale (CIPS; Clance 1985). Together with the association between IS and burnout, we consider a set of possible confounders based on the literature, as socio-demographic factors, working environment and individual personal beliefs as self-efficacy.

Our work contributes to the literature in different ways: (1) this is the first study to integrate validated psychological scales with self-reported perceptions of work conditions among early-career researchers; (2) unlike most of the existing literature, it explores burnout and its association with IS in academia beyond the commonly studied medical profession (Ojeda 2024); (3) it offers a novel perspective on the role of internal psychological mechanisms as key determinants of burnout, shifting from socio-demographic characteristics and job demands to how individuals interpret and respond to them (O'Connor et al. 2018).

The remainder of the paper is organized as follows. In Section 2, we present current literature on burnout and illustrate the Directed Acyclic Graph (DAG) on the link between IS, burnout, and relevant variables. Section 3 presents the survey design, while Section 4 explains our empirical

model implementation. Finally, Section 5 is dedicated to results of the analysis and Section 6 to the discussions and conclusions.

2. Background

2.1. Burnout in academia and the role of psychological factors

Burnout is a specific psychological response to chronic work-related stress (Maslach et al. 2001) originally defined by three dimensions: mental exhaustion, cynicism and depersonalization, and reduced personal accomplishment (Maslach and Jackson 1981). Later developments reconceptualize lack of achievement more as an outcome of burnout than a core component and emphasize two facets: *inability to invest energy*—related to exhaustion, emotional and cognitive impairment—and *unwillingness to invest energy*, linked to mental distance (Schaufeli et al. 2020). Literature highlights as its major determinant the high workload (Demerouti et al. 2001; Maslach et al. 2001; Ojeda 2024) which can in turn affect the salary perception as not aligned with the level of responsibilities, all these leading to exhaustion and disengagement (Maslach et al. 2001; Forrester 2023).[1]

In the academic context, these challenges are intensified and widespread across different disciplines (Hall 2023; Schwaller 2024), up to the point where some argue that burnout is part of working in academia—an environment where efforts are often undervalued and pressure dominates (Gewin 2021).

This section reviews the literature on burnout in academia with a specific focus on IS. We first discuss burnout and its main work-related determinants in academic settings. We then introduce IS as a relevant psychological mechanism that may shape how individuals experience and respond to these stressors, including socio-demographic characteristics and individuals' beliefs that might influence IS and burnout among early-career researchers.

The status quo of research culture is outlined in a global survey of 4200 researchers from 87 countries (Wellcome 2020). Researchers report pursuing their activity as a vocation; however, they also feel it is not sustainable in the long-term. Reasons are related to the increasing pressure to publish which appears to favor quantity over quality and the stringent competition that, instead of being an incentive to improve, is viewed negatively. Teaching and administrative duties increase workload which often does not allow an adequate work-life balance (Wellcome 2020). These conditions can be even more challenging for early-career researchers (Evans et al. 2018; Wellcome 2020): research, teaching, and publishing pressures are further exacerbated by the need to seek employment, while coping with financial instability and intense competition for a position (Cornér et al. 2017; Peltonen et al. 2017; Nagy et al. 2019). While at the beginning of their experience in academia, researchers are more positive and motivated, over the years they become less secure, and driven by uncertainty (Wellcome 2020). This is also confirmed by the rate of accessing mental health services among PhD students, which typically increases year by year during their PhD and peaks towards the end (Schwaller 2024).

The responsibilities on the job merge with nonwork duties, which can reinforce burnout feelings—for example family obligations. Individuals trying to balance parenting and professional demands may experience imbalance, feeling they fall short in both domains (Ojeda 2024). Indeed, coping with young children might affect workload as the work—family 'conflict' likely intensifies (Salmela-Aro and Upadyaya 2018): parents need to both comply with job requirements and take care of young children, making tasks that previously felt manageable as more daunting and harder to cope with (Grzywacz et al. 2002; Demerouti et al. 2012). Women often need to take over caregiving responsibilities along with work (Wellcome 2020; Gewin 2021), with

research showing that they typically score higher on exhaustion compared to men (Maslach et al. 2001). Similarly, people from minority backgrounds, particularly racial, face additional psychological burdens, including the pressure of representing their group in a positive way and feeling the need to overperform (Ojeda 2024). These issues raise serious concerns about the sustainability of the academic working environment. A better understanding of the determinants of burnout is therefore essential to inform strategies aimed at retaining talent and ensuring that academia remains a viable and attractive career path.

Although it is well-established that burnout is a work-related symptom—that is a direct consequence of an unhealthy working environment (i.e. workload, job insecurity, organizational culture)—emerging research (Ojeda 2024) highlights that burnout is not solely a product of external pressure, but it also depends on the way individuals experience and internalize stressors. For example, psychological traits such as IS may also contribute to either attenuate or intensify burnout condition. Specifically, faculty workers have been shown to report that moderate to high impostor thoughts led to higher levels of emotional exhaustion (Hutchins and Rainbolt 2017).

The correlation between IS and burnout can be explained by the extreme perfectionism that characterizes individuals with impostor traits. By considering unrealistically high standards the only way to prevent their incompetence from being exposed, they often adopt a relentless work ethic that undermines work-life balance (De Vries 2005). Fear of failure, self-doubt, and perceived lack of control can, to some extent, act as precursors to burnout, with increasing exhaustion and disengagement, even in the absence of objectively high job demand. Burnout, therefore, is not only a response to work stress but also a reaction to internalized psychological strain and feelings of inadequacy. This perspective explains why individuals with impostorism, despite manageable workload, can report high levels of burnout (Langton and Morley 2025).

The competitive and high-pressure setting of academia can significantly exacerbate impostorism. Within this context, individuals might question their own expertise, feeling stressed about developing and submitting scholarly grants, and compare themselves with colleagues, having difficulties to internalize awards and successful publications (Hutchins and Rainbolt 2017). Conversely, when failure occurs, they perceive it as a personal one, with consequent stress and negative impacts on teaching and research output (Hutchins 2015).

IS, as burnout, appears to be significantly linked to gender, as the majority of studies highlight a higher prevalence of IS on women with respect to men (Bravata et al. 2020), especially in fields where they remain underrepresented and need to strive for validation (Hutchins and Rainbolt 2017). This is also observed among ethnic minorities (Dancy and Jean-Marie 2014; Bravata et al. 2020). Minority groups might be more exposed to impostor feelings, due to low financial support, discrimination, and stereotypes (Woolston 2019) or the pressure to succeed and represent their community; more generally being the first in the family to pursue higher education can increase impostorism (Ewing et al. 1996; Cokley et al. 2017; Bravata et al. 2020). In terms of career stage, early-career academics might be particularly vulnerable to impostorism as they undergo major professional transitions that amplify uncertainty and self-doubt (Hutchins and Rainbolt 2017).

At the same time, certain individual characteristics are negatively correlated with the impact of burnout and IS. Self-efficacy in particular emerges as a protective factor for both constructs (Shoji et al. 2016; Todd and Mcilroy 2025). This refers to individual's self-confidence to successfully perform tasks and manage challenges and can be classified as a measure of stress adaptation (Luszczynska et al. 2005). Rooted in Social Cognitive Theory (Bandura 1977), self-efficacy helps reshape how individuals perceive their abilities by fostering a stronger sense of competence and control, thereby counteracting impostor feelings. This characteristic is the result of individuals' personal histories and directly linked to the social context they grew in, often showing significant differences across genders (Huang 2013). From infancy, families consistently

contribute to self-efficacy development. Features as financial status and parental education are key, for instance, lower educational background is negatively associated with it (Urdan and Pajares 2006).

While self-efficacy is related to early life stages, it is not a fixed trait, and it can be strengthened over time through experience and personal interactions (Bandura 1977). This is especially relevant in academia, where early-career researchers often lack the experiences that help increasing their confidence and ability to face difficulties. By contrast, individuals in more advanced career stages tend to demonstrate a stronger ability to cope with stress, having had more opportunities to develop self-efficacy (Schwarzer and Luszczynska 2008).

2.2. Conceptual framework

We illustrate the current knowledge on IS, burnout, and relevant variables described in Section 2.1 in a simple DAG (Pearl 2009; Lipsky and Greenland 2022; Cinelli et al. 2024). DAGs have increasingly been used as a tool to transparently put forward and discuss the identification of potentially causal relationships between some exposure variable(s) (X) and one or more outcomes (Y). In the following, we introduce the rationale behind the construction of our DAG and its implications for interpreting the results.[2]

When studying the possible causal paths between sets of exposures and outcomes, observed control variables play a key role in potentially blocking spurious relationships between the two. In particular, consider a covariate (vector) Z which enters a postulated causal relationship between X and Y. This can sit at different places in the path from the exposure to the outcome. Specifically, Z can be either (1) a mediator ($X \rightarrow Z \rightarrow Y$), (2) a common cause ($X \leftarrow Z \rightarrow Y$), or (3) a common effect or collider ($X \rightarrow Z \leftarrow Y$). Among these, mediators (1) are used to describe the *causal* mechanisms through which X affects Y, while when Z is either a parent (2—i.e. a common cause) or a child (3—i.e. a collider) of X and Y, it typically introduces a *non-causal* relationship between the two quantities of interest. While controlling for a common cause typically helps to improve the identification of the causal effect of X on Y (this is traditionally referred to as 'closing a backdoor path'), controlling for a collider creates, instead, spurious associations (Pearl 2009; Cinelli et al. 2024). Since the relationship between X and Y can involve many such structures, graphical models provide a helpful tool to visualising connections among variables and support researchers in formulating identification strategies and selecting necessary controls rather than including all available covariates (Pearl 2009; Cinelli et al. 2024; Henningsen et al. 2025). However, as DAGs grow in size, eliciting which covariates identify the effect of X on Y off a graph becomes quickly impractical. For this reason, several algorithms that input edges and nodes and output the minimal adjustment set, $\tilde{Z} \subseteq Z$, have been designed. Here we use the well-known procedure proposed by Pearl (2009) and implemented in the opensource software DAGitty (Textor et al. 2016).

Figure 1 shows the DAG representing the conceptual framework that supports our empirical approach discussed in Section 4. All variables and directed relationships included in the DAG are grounded in the literature reviewed in Section 2.1. We provide numerical superscripts on each arrow for the corresponding reference, that we also report in the Figure's footnote. In particular, the dashed circles indicate the minimum set of covariates, $\tilde{Z}$, that one would need to adjust for to satisfy the backdoor criterion (i.e. Career Stage, Minority, Self-efficacy, Gender, Parental Education), while the dashed arrows indicate the biasing paths. Moreover, the white nodes indicate variables that, although not strictly necessary to debias the causal path from X to Y, might still be useful as additional 'neutral' controls (i.e. Having Children, Salary Perception, Workload) to reduce residual variation in the outcome variable, thereby improving estimated treatment effects' precision in finite samples (Cinelli et al. 2024).

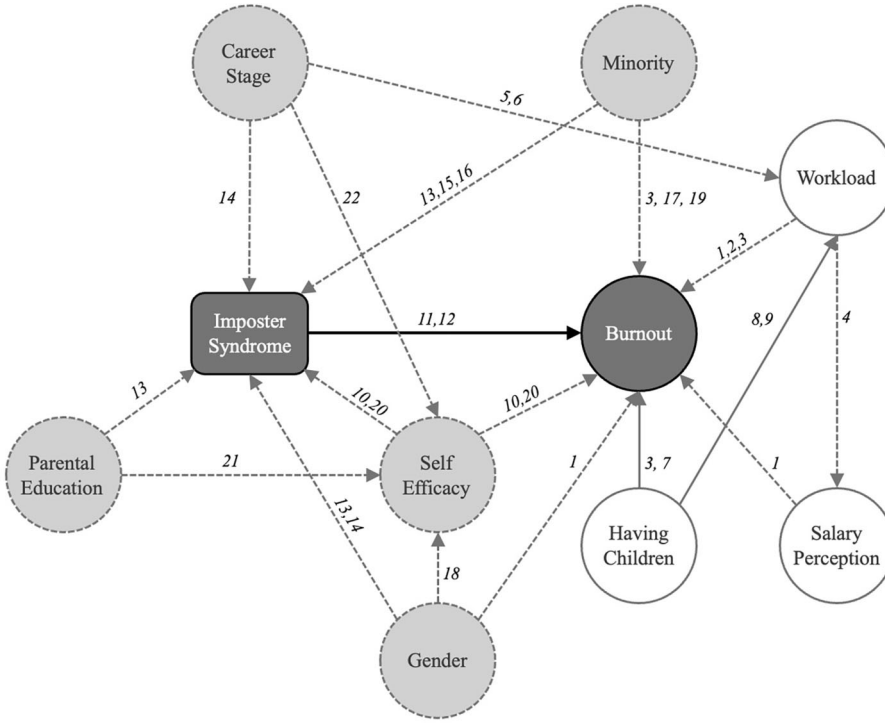

Figure 1 DAG representing the conceptual framework linking IS, burnout, and relevant variables. *Notes*: Career Stage, Minority, Self-efficacy, Gender, Parental Education, Having Children, Salary perception, and Workload are the control variables (Z) of our study. IS indicates the Exposure (X), while Burnout is the outcome of interest (Y). Literature: (1) Maslach et al. (2001); (2) Demerouti et al. (2001); (3) Ojeda (2024); (4) Forrester (2023); (5) Evans et al. (2018); (6) Wellcome (2020); (7) Salmela-Aro and Upadyaya (2018); (8) Grzywacz et al. (2002); (9) Demerouti et al. (2012); (10) Shoji et al. (2016); (11) De Vries (2005); (12) Langton and Morley (2025); (13) Bravata et al. (2020); (14) Hutchins and Rainbolt (2017); (15) Dancy and Jean-Marie (2014); (16) Woolston (2019); (17) Cokley et al. (2017); (18) Huang (2013); (19) Ewing et al. (1996); (20) Todd and Mcilroy (2025); (21) Urdan and Pajares (2006); (22) Schwarzer and Luszczynska (2008).

At this stage, it is worth reminding that the DAG in Fig. 1 only satisfies identification criteria based on observable covariates (i.e. conditional unconfoundedness). In other words, our path diagram does not include any unobserved common causes of X and Y, nor are there hidden confounders anywhere else in the variables network. Consequently, the backdoor criterion is instrumental in providing a meaningful interpretation of the results presented in Section 5.2. Additionally, Fig. 1 only aims at capturing a cross-sectional snapshot at the time of measurement. Therefore, we do not consider how this framework might evolve over time and whether reciprocal (i.e. cyclical) or consequent pathways may emerge in a future instance. Since these are both strong restrictions, we hereafter abandon the standard causal inference jargon and refrain from using strong epithets such as 'causal effect', 'treatment effect', or 'causal relationship'. Rather, we refer to the arrow connecting X to Y as simply 'association' or 'correlation' hoping that the identification strategy suggested in this section can at least safeguard against potential sources of bias based on observable characteristics.

3. Survey design

Data were collected through an online questionnaire administered via the Qualtrics platform and disseminated through snowball sampling, using the main social media and communication platforms (LinkedIn and WhatsApp) and the academic networks of scientific societies that transmitted the survey to their members via e-mail. The survey was conducted between February and March 2025 and 161 complete responses from early-career academics were collected. Participation in the study was voluntary and anonymous, and respondents were required to provide informed consent prior to starting the survey.[3]

The first section of the questionnaire gathered information on respondents' academic role (e.g. PhD student, postdoctoral researcher, assistant professor), and research area. The second section was devoted to assessing respondents' burnout through the BAT (Schaufeli et al. 2020), a validated instrument specifically designed to capture the multidimensional nature of this condition. In fact, the BAT conceptualizes burnout as a work-related mental state characterized by: (1) exhaustion, referring to severe physical and mental fatigue; (2) mental distance, capturing psychological disengagement from one's work; (3) cognitive impairment, relating to difficulties in attention, memory, and executive functioning; and (4) emotional impairment, reflecting reduced ability to regulate emotions in the work context.[4] As a result, the burnout scale comprises 12 items covering its core dimensions. Respondents indicated the frequency with which they experienced each symptom on a five-point Likert scale ranging from Never (1) to Always (5). We used these items to construct the corresponding latent trait as detailed in Section 4.1.

The third section of the questionnaire collected information on respondents' mental health condition. A set of items captured experiences related to mental health, including whether respondents had ever felt the need to consult a mental health professional, whether they had actually sought professional support, and whether they had received a mental health diagnosis after starting their PhD program—if they were current PhD students or held a PhD degree. In addition, respondents were asked to rate their overall mental health on a five-point scale and to report how many days during the previous week they had felt overwhelmed by their academic duties.

This was followed by questions related to IS in the fourth section, measured using the CIPS (Clance 1985)—a well-established instrument developed to assess the extent to which individuals experience chronic feelings of intellectual fraudulence, fear of failure, and inability to internalize success. The scale consists of 20 items covering key aspects of the impostor phenomenon, including the tendency to attribute success to external factors (such as luck), reluctance to accept praise, and persistent self-doubt about one's abilities. Respondents rated each statement on a five-point Likert scale ranging from Not at all true (1) to Very true (5). As with BAT, the IS latent construct was characterized using the methodology illustrated in Section 4.

In the fifth section, we measured individual internal beliefs in the form of self-efficacy through the six-item version of the General Self-Efficacy Scale (GSE-6; Romppel et al. 2013), a validated short form of the original scale developed by Schwarzer and Jerusalem (1995). The scale assesses individuals' general belief in their ability to cope effectively with a wide range of challenging and unexpected situations. Respondents indicated their agreement with six statements reflecting key dimensions of self-efficacy, such as persistence in pursuing goals, coping with adversity, resourcefulness, and emotional self-regulation, using a five-point Likert scale ranging from Not very true of me (1) to Very true of me (5). A self-efficacy latent score was also estimated as discussed in Section 4.

The final section of the questionnaire gathered socio-demographic information, including age, gender, years of academic experience, weekly working hours, perceived adequacy of salary relative to job responsibilities, nationality, country of origin, country of residence, ethnicity, number of children, and parental education.

4. Empirical model

4.1. Measurement error model

Our modelling exercise begins by arranging individual interviewees according to the unobservable attributes of burnout, IS, and self-efficacy. This model-based sorting is conditional on the scores emerging from the polytomous survey data discussed in Table 2. When a latent characteristic is elicited through multiple survey items in a context-tailored questionnaire, Item Response Theory (IRT) models provide a sound theoretical framework for linking individual responses to such unobservable individual features.

Specifically, when interviewees are asked to compile Likert-valued assessment statements, the Graded Response Model (GRM, Samejima 1968; Van der Linden (2016)) represents one of the most general and widely adopted models to map discrete responses to random person-specific (i.e. respondent-specific) and item-specific parameters. The standard IRT lingo refers to these two objects as 'person ability' (i.e. the latent trait(s) of interest, θ) and 'discrimination parameters' (i.e. how rapidly the probability of choosing a higher score increases with the person ability, α), respectively.

Mathematically, the GRM can be seen as a simple ordinal logit (Bürkner and Vuorre 2019; Svetina Valdivia and Dai 2024) modeling the probability that respondent $j \in 1, \ldots, N$ chooses to answer c in item $k \in 1, \ldots, K$, i.e.

$$F_{k,c}(\theta_j) = \Pr(I_{j,k} \geq c | \theta_j, \alpha_k, \boldsymbol{\delta}_k) = \frac{\exp(\alpha_k \theta_j - \delta_{k,c})}{1 + \exp(\alpha_k \theta_j - \delta_{k,c})} \tag{1}$$

for $c \in 1, \ldots, C-1$, where C indicates the higher integer value in a Likert scale, $F_{k,0}(\theta_j) = 1$, $F_{k,C}(\theta_j) = 0$ and the sequence of thresholds $\delta_{k,0} < \ldots < \delta_{k,c} < \ldots < \delta_{k,C} = \infty$ represents flexible boundaries between consecutive response categories. Notice that, unlike other IRT specifications such where item 'difficulties' explicitly appear in the linear component of equation (1), the double indexing of the threshold parameters in a GRM indicates that these coefficients can be used to define the points along the latent trait where the probability of choosing any discrete option exceeding a given category is 50 per cent. Moreover, model (1) is statistically not identified because of several forms of indeterminacy.

Formally, these can be laid out as: (1) additive aliasing—adding or subtracting any constant to $\alpha_k \theta_j - \delta_{k,c}$ leaves $F_{k,c}(\theta_j)$ unchanged; (2) multiplicative aliasing—multiplying or dividing α_k by any constant does not affect the probability of endorsing option c; (3) reflection invariance—switching the signs of α_k also produce the same response choice.

These shortcomings can be addressed by imposing three simple constraints to model (1): (1) fix $E[\theta_j] = 0$; (2) fix $V(\theta_j) = 1$, and (3) force all $\alpha_k \geq 0$ (Bafumi et al. 2005; Stoetzer et al. 2025). In many circumstances, however, $E[\theta_j] = 0$ can be a very restrictive assumption as researchers are often interest in specifying the expected value of the latent trait as a latent regression via $E[\theta_j | \boldsymbol{X}_j] = \beta_0 + \boldsymbol{X}_j^{\intercal} \boldsymbol{\beta}$ (Fox 2005; Zhou 2019; Varacca 2025). In this case, restriction *(i)* can be replaced by setting one threshold parameter to zero and centering/scaling all the covariates in the P-dimensional vector $\boldsymbol{X}_j$. This is exactly the statistical identification strategy that we adopt in this paper. More precisely, our work focuses on estimating the regression parameter β_{IS} in the conditional expectation function of θ_j^{B}, that is the latent burnout measure for respondent j:

$$E\left[\theta_j^{\text{B}} | \boldsymbol{X}_j, \theta_j^{\text{IS}}, \theta_j^{\text{Self}}\right] = \beta_0 + \beta_{\text{IS}} \theta_j^{\text{IS}} + \beta_{\text{Self}} \theta_j^{\text{Self}} + \boldsymbol{X}_j^{\intercal} \boldsymbol{\beta} \tag{2}$$

In equation (2), θ_j^{IS} and θ_j^{Self} indicate two additional latent characteristics capturing respondents' IS and self-efficacy, respectively. These are also estimated by modeling the corresponding observed scales through a GRM model, to which the restriction (1) to (3) discussed above

are also applied. Finally, the p-dimensional vector $\boldsymbol{X}_j$ collects all the measurable covariates discussed in Table 2 and Section 5.1.

4.2. Estimation

Model (1) can be estimated by either expectation maximization (EM—Zhou 2019), maximum likelihood, or Bayesian methods (Fox 2005; Bürkner 2019; Varacca 2025). The latter have recently gained attention due to their straightforward implementation in modern Hamiltonian Monte Carlo (HMC)—based samplers that are typically available in popular software packages such as Stan (Gelman et al. 2015) or PyMC (Abril-Pla et al. 2023). Moreover, the restrictions discussed in Section 4.1 can be easily implemented in a Bayesian framework through sensible choices of prior distributions for θ, α and δ.

In particular, Luo and Jiao (2018); Bürkner (2019); and Varacca (2025) recommend the following weakly-informative priors (Lemoine 2019):

$$
\begin{aligned}
\alpha_k^B, \alpha_k^{\text{IS}}, \alpha_k^{\text{Self}} &\sim \text{logNormal}(1,\ 1) \qquad \text{for all } k \in 1, \ldots, K \\
\delta_{k,c}^B, \delta_{k,c}^{\text{IS}}, \delta_{k,c}^{\text{Self}} &\sim \text{Normal}(0,\ 3) \qquad \text{for all } k \in 1, \ldots, K \text{ and } c \in 0, \ldots, C-1 \\
\theta_j^{\text{B}} &\sim \text{Normal}\Big(\beta_0 + \beta_{\text{IS}}\theta_j^{\text{IS}} + \beta_{\text{Self}}\theta_j^{\text{Self}} + \boldsymbol{X}_j^{\intercal}\boldsymbol{\beta}, 1\Big) \qquad \text{for all } j \in 1, \ldots, N \\
\theta_j^{\text{IS}} &\sim \text{Normal}(0,\ 1) \qquad \text{for all } j \in 1, \ldots, N \\
\theta_j^{\text{Self}} &\sim \text{Normal}(0,\ 1) \qquad \text{for all } j \in 1, \ldots, N \\
\beta_p &\sim \text{Normal}(0, 1) \qquad \text{for all } p \in 1, \ldots, P
\end{aligned} \tag{3}
$$

Combining the distributions in equation (3) with the data model (i.e. the likelihood) presented in equation (1) yields the complete Bayesian model $p(\mathcal{D}, \boldsymbol{\Phi}) = p(\mathcal{D}|\boldsymbol{\Phi})p(\boldsymbol{\Phi})$, where $\mathcal{D}$ indicates all the observed quantities (items and covariates), while $\boldsymbol{\Phi}$ includes all the random component (i.e. all the parameters) of the model. The object of interested is the posterior distribution of $\boldsymbol{\Phi}$, which can be expressed as $p(\boldsymbol{\Phi}|\mathcal{D}) = p(\mathcal{D}|\boldsymbol{\Phi})p(\boldsymbol{\Phi})/p(\mathcal{D}) \propto p(\mathcal{D}, \boldsymbol{\Phi}) = p(\mathcal{D}|\boldsymbol{\Phi})p(\boldsymbol{\Phi})$, where $p(\mathcal{D}|\boldsymbol{\Phi})$ and $p(\boldsymbol{\Phi})$ correspond to equations (1) and (3), respectively. HMC sampling tackles $\log p(\boldsymbol{\Phi}|\mathcal{D}) \propto \log p(\mathcal{D}|\boldsymbol{\Phi}) + \log p(\boldsymbol{\Phi})$ directly, providing a Monte Carlo approximation of $p(\boldsymbol{\Phi}|\mathcal{D})$, up to proportionality. In particular, most of the discussion in Section 5 will revolve around $p(\beta_{\text{IS}}|\mathcal{D})$, that is the posterior distribution of coefficient capturing the shift in θ_j^B for a standard deviation change in θ_j^{IS}.

5. Results

5.1. Descriptive statistics

Table 1 reports the sample characteristics while Table 2 reports the descriptive statistics for the variables used in our main model. Our sample is composed by 56 per cent women and 44 per cent men and covers early-career academics, with an average age of around 30 years, primarily affiliated with European universities (84 per cent). Respondents come from different fields, ranging from agricultural economics, agricultural sciences, food technologies and nutrition, applied economics, STEM, environmental sciences, social sciences, and humanities. A majority are currently enrolled as PhD students (67 per cent), followed by post-doctoral researchers (17 per cent), researchers (9 per cent), and assistant professors (7 per cent).

Most of individuals (55 per cent) works 40 h or less per week, with the majority in the 31–40 h window, although a substantial share (45 per cent) works >40 h in typical week. Early career

Table 1 Sample description.

	Mean (SD)	Min	Max
Socio-demographic			
Age	29.89 (3.82)	23	39
Are you a national of the country you live in? (Y/N)			
Yes, I am a national of the country I live in	0.71	0	1
Where are you from?			
Africa	0.06	0	1
America[a]	0.12	0	1
Asia	0.11	0	1
Europe	0.71	0	1
In which country do you work/study?			
Africa	0.00	0	1
North America[b]	0.14	0	1
Asia	0.02	0	1
Europe	0.84	0	1
Experiences and Mental Health condition			
Which of the following best describes your current role in academia?			
PhD Student	0.67	0	1
Post doc researcher	0.17	0	1
Researcher	0.09	0	1
Assistant professor	0.07	0	1
What is your field of study?			
Agricultural Economics	0.25	0	1
Agricultural Sciences	0.15	0	1
Applied Economics	0.10	0	1
Environmental Sciences	0.05	0	1
Food Technologies and Nutrition	0.15	0	1
Social Sciences and Humanities	0.05	0	1
Other STEM	0.10	0	1
Other	0.15	0	1
During during my professional journey…			
I have never felt the need and have not sought a professional for my mental health condition	0.26	0	1
I have felt the need but have not sought a professional for my mental health condition	0.27	0	1
I have felt the need and have sought a professional for my mental health condition	0.47	0	1
How would you rate your mental health overall? (1–5)			
Mental health score	3.24 (0.86)	1	5
Over the last 7 days, on how many days did you feel overwhelmed by the work you had to do?			
0–1 days	0.29	0	1
2–3 days	0.42	0	1
4–5 days	0.20	0	1
6–7 days	0.09	0	1

Table 1 (*Continued*)

	Mean (SD)	Min	Max
If you hold a PhD or currently enrolled in a PhD, have you been diagnosed by a mental health professional with any mental health issue(s) after you started the program? (Y/N)			
Yes, I received a mental health diagnosis	0.21	0	1
How big do you perceive your chance of finding a job in academia (beyond Postdoc) (1 = Very small chances, 5 = Very big chances)	2.65 (1.03)	1	5
Does your current salary/scholarship allow you and your family (if applicable) to live a comfortable life? (1 = Not at all, 5 = Completely)	2.88 (1.30)	1	5
Which of the following sectors would you most like to work in when you complete your PhD (beyond a Postdoc)?			
Academia	0.38	0	1
Industry	0.23	0	1
National government	0.01	0	1
Research center	0.24	0	1
EU	0.09	0	1
Non-profit organizations	0.04	0	1
Other	0.02	0	1

Notes: [a]Respondents from North, Central, and South America were grouped together given the small number of respondents from Central and South America. [b]No respondents stated they work/study in Central or South America while one respondent reported working/studying in Canada, therefore we report these under 'North America'.

scholars report an average experience of 5 years and state a misalignment between compensation and work responsibilities, rating salary adequacy 2.23 (SD = 1.25) on a 1–5 scale. In terms of nationality and mobility, 71 per cent of respondents are nationals of the country they live in, with Europe being the most represented region, followed by America, Asia and Africa. 78 per cent of respondents define themselves as 'white'.

Turning to respondents' mental health status, the sample average sits at 3.24 out of 5—SD = 0.86. Nearly three out of four respondents (74 per cent) report having felt the need to seek professional support for mental health issues. Specifically, 47 per cent did look for help, while 27 per cent did not, despite feeling the need. Only 26 per cent reported to never having felt the need for such support. In addition, one third declares having felt overwhelmed by their work for 4 days or more during the prior week. On the role of PhD programs on mental health, among PhD candidates and graduates, 21 per cent report having received a mental health diagnosis *after* starting their doctoral program. When asked about career prospects, PhD respondents expressed the desire to remain in academia (38 per cent), in research centers (24 per cent) and industry (23 per cent), while the remainder opt for EU institutions (9 per cent), nonprofit organizations (4 per cent), other sectors (2 per cent), and national governments (1 per cent). However, when asked to rate the likelihood to obtain a job in academia on a 1–5 scale, this is reported relatively low (mean = 2.65; SD = 1.3). In terms of parental background, half of respondents' parents hold high school diploma or above.

To understand the extent to which our responds experience burnout, we aggregated the 12-items BAT scale following the procedure proposed by Schaufeli et al. (2020). We first averaged the 12 items, yielding a construct with mean score 2.60 (SD = 0.64). We next placed this value in one of three clinical brackets: 1.00—2.53, no risk of burnout; 2.54—2.95, at risk of

Table 2 Variables used in the main model.

	Mean (SD)	Min	Max
Outcome variable			
Burnout scale, *Cronbach's* $\alpha = 0.88$	2.60 (0.64)	1.33	5
Exposure variable			
CIPS score, *Cronbach's* $\alpha = 0.75$	64.11 (14.85)	27	99
Control variables			
Self-efficacy scale, *Cronbach's* $\alpha = 0.83$	19.15 (4.36)	6	29
What best describes your gender identity?			
Male	0.44	0	1
Female	0.56	0	1
How many years of experience do you have in academia?			
Years of experience	5.52 (3.90)	0	20
On average, how many hours per week do you typically work?$*$			
$<$11 h	0.02	0	1
12–20 h	0.03	0	1
21–30 h	0.09	0	1
31–40 h	0.40	0	1
41–50 h	0.31	0	1
51–60 h	0.10	0	1
61–70 h	0.02	0	1
71–80 h	0.01	0	1
$>$ 80 h	0.01	0	1
Do you think your salary is commensurate with your workload and responsibilities? (1 = Definitely not, 5 = Definitely yes)			
Salary	2.23(1.25)	1	5
How would you define your ethnicity?			
White	0.78	0	1
Asian	0.07	0	1
Other	0.07	0	1
Hispanic or Latino	0.06	0	1
Black or African American	0.01	0	1
How many children do you have?			
Children	0.24 (1.09)	0	9
Did your father/mother (biological or step) complete high school or earn an equivalent diploma?			
High school father	0.46	0	1
High school mother	0.54	0	1

Notes: The items for the Burnout scale, for CIPS scale and for the self-efficacy scale are presented in Appendix A, respectively, in lists A1, A2, and A3. * We included the variable in the main model as a binary indicator, assigning a value of 1 to individuals who reported working $>$40 h per week, and 0 otherwise; given the large share of PhD students in the sample and the lack of differentiation between teaching and studying activities, actual working hours in the sample might be underestimated.

burnout; 2.96—5.00, very high risk of burnout. Therefore, our sample information suggests that the participants to our survey are on average at risk of burnout. Similarly, we summarize the scores of the exposure variable, IS, by summing the 20-item responses within the CIPS (Clance 1985). This measure helps identifying whether respondents exhibit impostor characteristics and how strong these are. With sum scores ranging from 20 to 100, Clance (1985) classifies individual

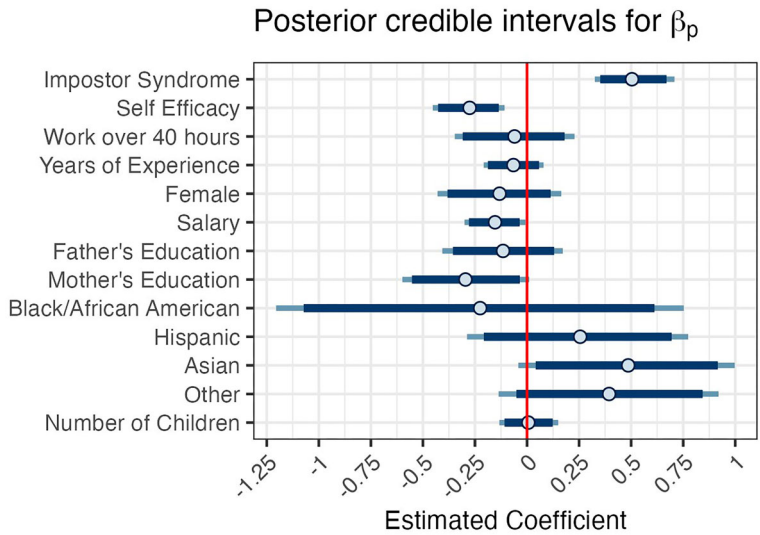

Figure 2 Estimation results for the (model standardized) regression coefficients of interest.

values between 61 and 80 as frequently experiencing impostor feelings. Therefore, our 64.11 (SD = 14.85) average sum score suggests that the respondents in our sample frequently experience IS. We repeat the process for the self-efficacy construct (i.e. the GSE-6) and find that average self-efficacy score in our sample amounts to 19.15 (SD = 4.36) on a 6 to 30 scale.

Finally, notice that this way of aggregating items into score constructs (i.e. averaging and summing) does not correspond to how items are employed in our empirical model. Rather, these simple summary statistics are only constructed to match our observed responses against the existing measures of burnout, IS, and self-efficacy. As thoroughly discussed in Stoetzer et al. (2025), however, such shortcuts are unnecessary or even undesirable when the goal is evaluating the association between these two latent variables.

5.2. Model results

Figure 2 reports the estimated parameters for model (2). The dark thick lines indicate the 90 per cent credible intervals (CI) for the regression coefficients, calculated as the 5 per cent and 95 per cent quantiles of $p(\beta_p|\mathcal{D})$. Similarly, the light blue bars show the 95 per cent CI computed as the 2.5 per cent and 97.5 per cent quantiles of $p(\beta_p|\mathcal{D})$, while the central dots represent the maximum-a-posteriori estimate (i.e. the median) of the corresponding posterior distribution.

The main objective of this study was to reliably identify and quantify the interplay between IS and burnout. Implementing the backdoor criterion allowed us to improve the credibility of the corresponding regression coefficient by characterizing the minimal set of controls blocking all the hypothesized biasing paths created by observable confounders. We therefore expect this approach to reduce potential bias and bring empirical evidence closer to a hardly attainable causal relationship.

Results from our model suggest an average positive change in burnout for a unit difference in the IS latent trait. Specifically, since latent constructs are dimensionless features approximately defined on a $[-3, +3]$ scale, the regressions parameter for θ^{IS} is hard to interpret on its natural support. For this reason, we rescale β_{IS} by the total standard deviation of θ^{B} (i.e. $\tilde{\beta}_{IS} = \beta_{IS}/sd(\theta^{B})$) such that the 0.5 estimated coefficient for IS indicates that a unit change in

the corresponding latent variable is associated with an average increase in burnout by approximately 0.5 standard deviations. A standardized coefficient of this magnitude is typically regarded as 'moderate-to-large'[5] (Cohen 1988).

Since the backdoor criterion focuses on the association between IS and burnout, we do not discuss the potential implications of other covariates' (socio-demographics, work environment, and internal beliefs—self-efficacy) estimated coefficients. However, we highlight some of the correlations (or lack thereof) that emerge from the analysis and argue that these could be further explored in future research with appropriately devised identification strategies.

In particular, the 95 per cent credible intervals suggest that lower average values of the latent burnout construct emerge when comparing respondents whose salary differs by one standard deviation. The same is true for other socio-demographic characteristics such as the education level of the female relative (although the same pattern does not show when switching to the male relative). On the other hand, Asian respondents show a higher level of burnout, although the latter is only clearly defined through the 90 per cent credible intervals. We do not observe evident changes in burnout for the remaining observable controls such as other ethnicity indicators, gender, working hours, years of experience, and the number of children. Finally, self-efficacy emerges as negatively related with burnout. Our model shows that an increase by a standard deviation in the self-efficacy latent construct yields an average drop in burnout of approximately 0.25 standard deviations.

6. Discussion and conclusion

This study explored the association between two salient issues in academia, burnout and IS, with a particular focus on early-career researchers. Specifically, we aimed to understand the extent to which IS influenced the development of burnout condition. By shifting the analytical lens beyond conventional work-related stressors and socio-demographic factors, this study adds to the literature by foregrounding the role of internal psychological mechanisms in shaping vulnerability to burnout.

Results indicate an association between IS and burnout, meaning that individuals showing IS symptoms are more likely to be at risk of burnout. This finding aligns with the conclusions by Villwock et al. (2016) and Bravata et al. (2020) and reinforces the importance of internal psychological factors in shaping how individuals respond to academic stressors. In particular, IS appears to function as a behavioral distortion that amplifies the perception of job-related demands. As a result, the internal valuation process researchers apply to their own productivity and performance becomes misaligned with external expectations. This misalignment leads to increased psychological strain, even in the absence of objectively extreme work conditions.

The increase in burnout risk is associated with more severe symptoms in terms of exhaustion, disengagement, and impairment as part of this condition (Schaufeli et al. 2020). However, significant associations have also been found with mental health issues such as depression or anxiety (Koutsimani et al. 2019). Moreover, in the working context, burnout is linked with thoughts of dropping out and negative perceptions of future job opportunities (Nagy et al. 2019).

To mitigate these consequences, concrete actions should be taken. On this matter, some studies advocate for tailored individual strategies (see Heslop et al. 2023 for a summary), while others emphasize the importance of professional support, such as therapy, coaching, or confidence-building interventions (Langford and Clance 1993; Zanchetta et al. 2020). However, Feenstra et al. (2020) caution that focusing solely on individual solutions may be insufficient. These approaches risk overlooking the role of the broader organizational and social context in fostering impostorism and may inadvertently reinforce a narrative of individual responsibility. Trying to 'fix' oneself can reinforce feelings of inadequacy and the self-perception of not fitting

in. In this context, the authors highlight how changing the working context by promoting diversity, improving communication, and creating environments where individuals feel valued, worthy, and that they belong can represent a preventive action to reduce the occurrence of IS.

While defining to what extent internal dimensions interact with the external environment and drives impostorism is beyond the scope of our study, we believe that actions that combine individual, organizational, and systemic shifts are the most effective in mitigating IS and possibly reduce the risk of burnout. A fundamental role is played by leaders who are asked to shape a new positive research culture and a more supportive environment which values individuals and their identity (Heslop et al. 2023). Feigofsky (2022) emphasizes the importance of a safe place that normalizes vulnerability and self-doubt. This implies also a shift from competition and peer-comparison to learning, reflection, and goal setting, avoiding pressure to overachieve.

Moreover, our findings suggest that higher self-efficacy is correlated with lower levels of burnout. This aligns with prior research (Shoji et al. 2016) and reinforces the protective role of individual psychological traits against work-related stress and emotional exhaustion. Yet, since our model was not explicitly designed to identify a causal pathway from self-efficacy to burnout, future research could identify this potential mechanism directly, for instance through experimental interventions aimed at boosting self-efficacy and observing downstream effects on burnout.

The present study lays the groundwork for further research into the development of burnout in academia among early-career researchers in different fields. This cannot be done without considering the internal psychological constructs, such as IS, that characterize how individuals perceive and respond to the pressures of academic life. While individual-level interventions can be taken, they are unlikely to be sufficient in the absence of broader structural and organizational changes.

A significant implication of our findings concerns the structural inefficiencies that IS may generate within the academic labor market. The widespread presence of impostor-related distress among early-career researchers risks undermining universities' capacity to retain and develop highly skilled talent. If impostorism systematically contributes to higher levels of burnout and early attrition, institutions may face a silent erosion of human capital, as individuals may exit the profession despite having successfully passed competitive selection processes. This dynamic represents not only a misallocation of invested resources but also a potential long-term drag on productivity and innovation within knowledge-intensive sectors. Recognizing and addressing impostor-driven burnout in academia is therefore not only a matter of individual wellbeing, but also of organizational performance and systemic efficiency.

Academic institutions must foster working environments that promote inclusion, openness, and mentorship, counterbalancing the competitive dynamics and performance pressures that often dominate the early stages of academic career. Effective policies might include structured peer mentoring schemes that provide early-career researchers with relatable role models and a space for normalizing uncertainty and self-doubt. Revisiting tenure-track frameworks to reduce job insecurity and delay in career progression could also help mitigate the performance anxiety that feeds impostor experiences. Moreover, institutional investments in psychological support services can reinforce resilience without placing the entire burden on the individual. Importantly, these interventions should not be viewed as peripheral, but as integral components of academic capacity building and talent retention strategies.

This study has several limitations that should be acknowledged. First, as an observational study, our analysis cannot fully rule out the influence of unmeasured confounders. While we rely on a set of observed covariates, latent characteristics, such as personality traits, prior mental health history, or departmental culture, may still bias the estimated association between IS and burnout. In addition, our analysis focuses on contemporaneous relationships between

variables at the time of measurement, rather than dynamic feedback loops, therefore, we do not capture possible shifts occurring over time.

Second, the sample consists of self-selected early-career researchers who voluntarily participated in the survey, introducing potential selection bias. Individuals experiencing higher levels of impostorism or burnout may have been more motivated to respond, possibly inflating observed associations. Moreover, our sample size is relatively small and not representative of the broader population of early-career researchers or doctoral candidates. Most respondents are based in Europe, with limited representation from minority groups. This reduces our ability to explore differential effects across demographic or institutional contexts and limits the generalizability of our findings to more diverse academic settings. Finally, as the study relies on self-reported measures, the results may be affected by perceptual inaccuracies or social desirability bias. Although constructs such as burnout and IS are introspective in nature, respondents may underreport symptoms due to professional stigma or overstate them in an attempt to normalize emotional distress.

End notes

1 Salary perception is considered a work-related variable, reflecting a context where imbalances between rewards and responsibilities occur.
2 Our description remains non-technical, and we refer interested readers to Pearl (2009), Cinelli et al. (2024), and Henningsen et al. (2025) for a comprehensive overview of the underlying theory.
3 Ethical approval for the study was obtained from the Institutional Review Board of the German Association for Experimental Economic Research (Certificate No. Md1WR2Mz).
4 The BAT also includes items measuring secondary symptoms of burnout, namely, psychological distress and psychosomatic complaints (items 13–22). Following the recommendations of Schaufeli et al. (2020), we focused on the core dimensions of burnout (exhaustion, mental distancing, cognitive impairment, and emotional impairment) to derive an overall burnout score. The secondary dimensions were excluded from the analysis as they are not considered constitutive elements of the burnout syndrome itself.
5 For a more intuitive comparison, note that on the approximately standard-normal latent scale the 25th and 75th percentiles of θ^{IS} are about -0.67 and $+0.67$; therefore, an interquartile increase in IS (i.e., $|-0.67 - 0.67| = 1.35$) would correspond to an expected increase in burnout of about $0.5 \times 1.35 \approx 0.67$ standard deviations.

Supplementary material

Supplementary material is available at *Q Open* online.

Conflicts of interest

None.

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Data availability

The data underlying this article will be shared on reasonable request to the corresponding author.

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