# SYSTEMATIC REVIEW





# Global prevalence of imposter syndrome in health service providers: a systematic review and meta-analysis

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# Abstract

Background Imposterism, also known as imposter syndrome or imposter phenomenon, is an emerging phenomenon that has attracted much attention in recent years. Given that this phenomenon is common among high-achieving individuals and its identification often overlaps with symptoms of anxiety, depression, stress, and burnout, the aim of this study is to determine the global prevalence of imposter syndrome and its associated factors.

Methods For this study, PubMed, Embase, ScienceDirect Web of Science, Scopus, and Google Scholar databases were systematically searched, and all relevant studies were transferred to EndNote (v.8) and reviewed. Data analysis was performed using Comprehensive Meta-Analysis (v.2) software; a random effects model was adopted for analysis, and the  $I^2$  index was used to examine the heterogeneity of studies.

**Results** In a review of 30 studies with a sample size of 11,483 people, the prevalence of imposter syndrome was 62% (95% CI: 52.6–70.6) based on meta-analysis and the random effects method. In examining the factors affecting the heterogeneity of studies and the effect of sample size on this heterogeneity, it was found that with increasing sample size, the prevalence of imposter syndrome decreases (p < 0.05), and with increasing years of studies, the prevalence of imposter syndrome increases (p < 0.05). Additionally, in this study, self-esteem, anxiety, depression, stress, and burnout were identified as the most important factors associated with imposter syndrome.

**Conclusion** Given the relatively high prevalence of imposter syndrome, which is a serious psychological challenge and can negatively affect the mental health and performance of individuals, the results of this study provide useful information for designing appropriate policies and interventions to develop effective pertinent solutions.

Keywords Imposter, Imposter Syndrome, Imposter phenomenon, Prevalence, Meta-analysis

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## Background

Individuals experience anxiety, self-doubt, and feelings of alienation in situations where their abilities, performance, and competence are constantly evaluated. This sense of alienation, or 'fraud', is what gives rise to imposter syndrome (IS). IS is characterized by a persistent inability to attribute one's achievements to personal merit, instead attributing successes to luck or other external factors [1, 2]. From the perspective of Bandura's self-efficacy theory, IS can profoundly affect one's self-confidence and potential for success [3–5]. Since low self-efficacy can affect a wide range of life outcomes, from academic success to mental health, it is imperative to explore the complexities of IS further [6].

Contrary to earlier beliefs that IS was limited to specific groups (such as women), recent research suggests that the phenomenon is pervasive across genders, cultures, and professional backgrounds [7, 8], particularly among those working in the medical field, such as medical students, medical residents, and physicians [9–12]. A nationwide survey of 3,000 physicians in the United States conducted between 2020 and 2021 found that 1 in 4 physicians experienced frequent or severe symptoms of IS [13]. In fact, physicians have an 80% higher relative risk of experiencing IS symptoms than other professions [13]. In addition, the syndrome is also relatively prevalent among various other population groups, including computer science students, university librarians, and pre-service teachers [14–16].

The impact of occupations and their status on imposter syndrome has been well documented in the healthcare profession, with approximately 30% of medical students and residents reported to be identified as imposters, with the report being more gender specific among females and international medical graduates [14]. Imposter syndrome manifests itself at the beginning of new jobs and projects. Even experienced doctors are not immune and can suffer from this syndrome despite receiving positive feedback from peers and patients [14].

IS, although not recognized as a mental illness in the Diagnostic and Statistical Manual of Mental Disorders (DSM) or the International Classification of Diseases (ICD), is an experience that significantly impacts an individual's mental health and can extend its effects to physical and occupational impairments [17]. Individuals suffering from IS are less likely to speak up or volunteer answers and information compared to their peers who are not affected by the syndrome. These characteristics can have serious implications for the learning process in medical education. Students exhibiting high IS characteristics often avoid challenges and reject various learning opportunities for fear of making mistakes and exposing

their perceived inadequacies. This, in turn, leads to overall negative outcomes in healthcare delivery [9-16].

IS has been found to be significantly associated with indicators of burnout [18-20]. People who suffer from this syndrome often adopt long-term workaholism behaviors to achieve unrealistic goals, leading to a vicious cycle of blame, fatigue, and burnout [21], that impairs and exacerbates individuals' performance in work and academic situations. Furthermore, studies have shown that IS is associated with certain poor psychological functioning, such as low self-esteem, anxiety disorders, and psychological distress [22]. People who suffer from IS often struggle with feelings of helplessness and selfdoubt, which can lead to significant mental health challenges. These concerning results highlight the fact that recognizing such a psychological experience and increasing awareness about it can help individuals in various fields, including healthcare, to overcome the difficulties of the early stages of their careers. Therefore, considering the varying values reported in different studies with different populations, it is necessary to conduct a systematic review and meta-analysis to determine the global prevalence and factors associated with IS in the general population and to provide a consolidated value in this field. Therefore, the aim of this study is to determine the global prevalence of imposter syndrome (IS) and related factors through a systematic review and meta-analysis.

## Methods

The present study is a systematic review and meta-analysis conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [23]. To select relevant studies, a systematic search was conducted on 20 th of December 2024, across the international databases of PubMed, Embase, Scopus, ScienceDirect, Web of Science, and the Google Scholar search engine. The keywords "prevalence", "epidemiology", "consequence", "outcome", "Imposter phenomenon", "Imposter Syndrome", and "Imposter", along with the 'AND' and 'OR' operators, were used for the search. To ensure comprehensiveness and access to the maximum number of relevant studies, no restrictions were applied to the publication year. Additionally, a manual search of the relevant studies was conducted by examining the reference list of the identified articles. In this study, in order to examine gray literature, a general search was conducted on the Google search engine, as well as a review of the sources of articles obtained in the general review, and emails to authors who have worked in this field.

Our study aimed to answer the following research question "What is the global prevalence of imposter syndrome in society?" Keywords were extracted from the Medical Subject Headings (MeSH) database. PICO was defined in this study as follows: population (P) were: total health service providers, intervention (I): Without intervention, Comparison (C): Comparison with people without imposter syndrome and outcome (O) were: prevalence of imposter syndrome.

## **Inclusion criteria**

The following criteria were considered for inclusion of studies:

- 1. Original research studies,
- 2. Cross-sectional studies,
- 3. Studies for which the full text was available,
- 4. Studies published in English, and
- 5. Studies that provided sufficient data (i.e., prevalence of imposter syndrome).

### **Exclusion criteria**

Criteria that led to exclusion of studies are listed below:

- 1. Studies that were not relevant to the focus and context of this research work,
- 2. Studies published in languages other than English,
- 3. Animal studies,
- 4. Reviews of any sort,
- 5. Interventional studies, and
- 6. Case reports, and case series.
- 7. Studies that receive a low or poor score in the quality assessment (scoring below 16).

## Study selection

During the study selection stage, all studies were imported into EndNote (v.8) software, and duplicate articles from different databases were omitted. In the next stage, the titles and abstracts of the remaining studies were independently reviewed by two researchers, and studies that did not meet the inclusion criteria were excluded. Following this, each researcher reviewed the full texts of the studies and removed any irrelevant studies based on the inclusion and exclusion criteria. In cases of disagreement between the two researchers, the final review and decision were assigned to a third researcher to reach to reach a consensus. To prevent bias, the authors' information and the characteristics of the journals were concealed from the researchers.

## **Quality evaluation**

In the quality evaluation phase, the STROBE checklist was utilized, a suitable tool for evaluating the quality of observational studies [24, 25]. This checklist includes 6 sections that assess the title, abstract, introduction,

methodology, results, and discussion, along with 32 subscales. Considering that the tool's scores range from 0 to 32, a cutoff point of 16 was established. Studies scoring below 16 were excluded, while those scoring 16 or above were deemed as high-quality articles.

#### Data extraction

To extract relevant data, a separate checklist was created with fields including author's name, year of publication, study location, study type, number of participants, age range of subjects, gender, prevalence of imposter syndrome (IS), and the tool used to measure the imposter phenomenon. Data extraction was carried out separately by two researchers to ensure accuracy.

## Statistical analysis

The Comprehensive Meta-Analysis (v.2) was used for analysis. Heterogeneity across studies was assessed using the  $I^2$  index, publication bias was evaluated with the Funnel plot test, and the Begg and Mazumdar correlation test was employed to assess possible publication bias in the studies.

## Results

In this systematic review and meta-analysis, evidence within studies that had assessed the global prevalence of imposter syndrome (IS) in the general population was examined according to the PRISMA guidelines. Initially, 520 potentially relevant studies were identified through the search of databases and imported into EndNote software. After removing duplicates, 205 studies were excluded, leaving 315 studies. Subsequently, 241 irrelevant studies were excluded based on title and abstract review. The full text of the remaining studies was then assessed, leading to the exclusion of 44 studies based on the inclusion and exclusion criteria (including 4 studies excluded during the quality assessment stage), leaving 30 studies. These processes are presented in Fig. 1.

## General characteristics of the studies

The studies included in the analysis were published between 2004 and 2024. The highest prevalence of imposter syndrome (IS) was found in the study by Zoia et al., with a prevalence rate of 94% [26]. The majority of the studies included in this study were conducted in the United States (12 studies) and all of the studies were cross-sectional (Table 1).

## Global prevalence of imposter syndrome (IS)

In a review of 30 studies with a sample size of 11,483 participants, the  $I^2$  heterogeneity test revealed high heterogeneity ( $I^2$ : 98.6), prompting the use of the random effects method to analyze the results. Based on the



Fig. 1 PRISMA flow diagram for identifying relevant studies

meta-analysis, the prevalence of imposter syndrome was found to be 62% (95% CI: 52.6–70.6) (Fig. 2). Additionally, the Begg and Mazumdar correlation test for publication bias showed evidence of publication bias in the studies (p: 0.049) (Fig. 3).

In examining the factors influencing the heterogeneity of the studies and the effect of sample size on this heterogeneity, it was found that as sample size increases, the prevalence of imposter syndrome decreases (p < 0.05) (Fig. 4). Additionally, with an increase in the year of the study, the prevalence of imposter syndrome was observed to rise (p < 0.05) (Fig. 5).

Based on the results in Table 2, which reports the prevalence of imposter syndrome by measurement tool, the highest prevalence was reported using the Clance Impostor Phenomenon Scale (CIPS), with a prevalence of 64.5 (95%CI: 53.7–74.1), followed by the Young Impostor Scale (YIS) instrument, with a prevalence of 39.9% (95% CI: 25.8–55.9), Other measurement tools were only included in one study [55] and were not included in the analysis. (Table 2).

## Factors associated with imposter syndrome (IS)

Various studies have mentioned factors associated with the prevalence of IS (Table 3), however the rates for each associated factor have been reported differently. Additionally, the heterogeneous results have limited the possibility of conducting a meta-analysis of individual risk factors. Nonetheless, some factors associated with IS are highlighted in more details in the following sub-sections:

*Self-esteem* Normally, achievements contribute to the development of self-esteem. However, in individuals with

Instrument for single child status	population	prevalence of IS	Sample Size(n)	Location	year	Author
CIPS <sup>1</sup>	Medical Students	52.2	276	Oman	2023	Al Lawati et al. [27]
CIPS	Otolaryngologists	27.5	80	Saudi Arabia	2024	Alrasheed et al. [28]
CIPS	Medical Students	89.5	399	United Arab Emirates	2020	Alzufari et al. [29]
CIPS	Physical Therapists	51.2	514	USA	2024	Anderson et al. [30]
CIPS	Dental Students	84.1	162	Saudi Arabia	2023	Awinashe et al. [31]
CIPS	General Surgery Residents	76	144	USA	2021	Bhama et al. [32]
CIPS	Family Medicine	43	430	USA	2023	Carvajal et al. [33]
CIPS	Medical Students	41.81	165	Saudi Arabia	2023	Elnaggar et al. [34]
CIPS	Registered Dietitians	31.9	266	USA	2023	Hernandez et al. [35]
CIPS	Pharmacist	53	380	USA	2023	Macias-Moriarity et al. [36]
CIPS	Medical Students	65.4	399	Pakistan	2022	Mashhadi et al. [37]
CIPS	Medical Students	45.2	290	Bahrain	2022	Naser et al. [38]
CIPS	Medical Students	75.8	277	Canada	2023	Neufeld et al. [39]
CIPS	Nurses	85.9	78	UK	2024	Ord et al. [40]
CIPS	Family Medicine Residents	32.97	185	USA	2004	Oriel et al. [41]
CIPS	Medical Students	87	257	USA	2021	Rosenthal et al. [42]
CIPS	Pediatric Residency	62	133	Turkey	2024	Samur et al. [43]
CIPS	Physicians	23.1	3116	USA	2022	Shanafelt et al. [44]
CIPS	Undergraduate Clinical Medical Students	47.4	228	Thailand	2023	Shinawatra et al. [45]
CIPS	Respiratory Therapy (RT) Students	92	901	Saudi Arabia	2024	Siraj et al. [46]
CIPS	Employees in the National Univer- sity Health System (NUHS)	61	349	Singapore	2023	Tan et al. [47]
CIPS	Medical and surgical postgraduate trainees	91	201	Sri Lanka	2024	Vidanapathirana et al. [48]
CIPS	Young neurosurgeons and residents in neurosurgery	81.6	103	Italy	2022	Zaed et al. [49]
CIPS	Surgical Residents	36.53	156	Pakistan	2023	Zeb et al. [50]
CIPS	neurosurgeons	94	232	Europe	2024	Zoia et al. [26]
YIS <sup>2</sup>	Graduates of medical, dental and pharmaceutical sciences	57.8	384	Saudi Arabia	2020	Alrayyes et al. [51]
YIS	Medical Students	42.1	573	Saudi Arabia	2021	Alsaleem et al. [52]
YIS	Medical Students	24.3	523	Saudi Arabia	2024	El-Setouhy et al. [53]
YIS	Graduate allied health students	37.5	72	Australia	2020	Schmulian et al. [54]
online survey	Medical Students	90.7	230	USA	2024	Geiger et al. [55]

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<sup>1</sup> The Clance Impostor Phenomenon Scale

<sup>2</sup> young imposter scale

imposter syndrome (IS), the inability to internalize successes prevents the development of high self-esteem [65]. As a result, several studies have associated self-esteem with imposter syndrome (IS) [38, 41, 42, 46, 52, 53, 58, 65] (Table 3).

In a study by Naser et al., conducted among students at an international medical college in the Middle East, low self-esteem was found to be a strong predictor of imposter syndrome (p < 0.001) [38]. Oriel et al. found

that those who scored highest on the Imposter Syndrome Scale (CIPS) had the lowest self-esteem according to the Rosenberg Self-Esteem Scale ( $r^2 = -0.63$ , P < 0.0001) [41]. Rosenthal et al. reported that students with higher scores on the Imposter Syndrome (IS) scale had lower mean scores on the Social Self-Esteem scale (P < 0.0001) [42]. Similarly, El-Setouhy et al. found a significant negative correlation between imposter syndrome (IS) and self-esteem (P < 0.001) [53]. Siraj et al. also reported a significant correlation between IS and low self-esteem (P

Study name		Statisti	cs for e	ach stud	У		Ever	nt rate a	and 9	5 <u>% C</u> I	
	Event rate	Lower limit	Upper limit	Z-Value	p-Value						
Al Lawati.et al	0.522	0.463	0.580	0.722	0.470		1				
Alrasheed.et al	0.275	0.188	0.383	-3.872	0.000				-	Т	
Alzufari.et al	0.895	0.861	0.921	13.119	0.000						
Anderson.et al	0.512	0.468	0.555	0.529	0.597						
Awinashe.et al	0.846	0.782	0.894	7.822	0.000						
Bhama.et al	0.750	0.673	0.814	5.709	0.000						
Carvajal.et al	0.428	0.382	0.475	-2.979	0.003						
Elnaggar.et al	0.418	0.345	0.495	-2.092	0.036						
Hernandez.et al	0.320	0.266	0.378	-5.748	0.000						
Macias-Moriarity.et a	10.529	0.479	0.579	1.128	0.259						
Mashhadi.et al	0.654	0.606	0.699	6.055	0.000						
Naser.et al	0.452	0.395	0.509	-1.642	0.101						
Neufeld.et al	0.758	0.704	0.805	8.142	0.000						
Ord.et al	0.859	0.763	0.920	5.554	0.000						
Oriel.et al	0.330	0.266	0.401	-4.536	0.000						
Rosenthal.et al	0.872	0.825	0.907	10.271	0.000						
Samur.et al	0.549	0.456	0.638	1.033	0.302						
Shanafelt.et al	0.232	0.217	0.247	-28.232	0.000						
Shinawatra.et al	0.474	0.410	0.539	-0.794	0.427						
Siraj.et al	0.920	0.900	0.936	19.889	0.000						
Tan.et al	0.613	0.561	0.663	4.192	0.000						
Vidanapathirana.et al	0.910	0.862	0.943	9.388	0.000						
Zaed.et al	0.816	0.729	0.879	5.851	0.000					1	
Zeb.et al	0.365	0.294	0.444	-3.320	0.001						
Zoia.et al	0.940	0.901	0.964	9.958	0.000						
Alrayyes.et al	0.578	0.528	0.627	3.049	0.002						
Alsaleem.et al	0.421	0.381	0.461	-3.785	0.000						
El-Setouhy.et al	0.243	0.208	0.281	-11.152	0.000						
Schmulian.et al	0.375	0.271	0.492	-2.098	0.036				-	┣	
Geiger. et al	0.804	0.748	0.851	8.505	0.000						
	0.620	0.526	0.706	2.482	0.013						
						-1.00	-0.5	0 0.0	00	0.50	1.00
							Favou	rs A	Fav	ours	в

# **Meta Analysis**

# Meta Analysis

Fig. 2 Forest plot of the prevalence of imposter syndrome based on the random effect's method



# Funnel Plot of Standard Error by Logit event rate

Fig. 3 Funnel plot to examine publication bias in reviewed studies



**Regression of Sample on Logit event rate** 

Fig. 4 Meta-regression of the effect of sample size on the prevalence of imposter syndrome



## Regression of Years on Logit event rate

Fig. 5 Meta-regression of the effect of the year of study on the prevalence of imposter syndrome

Table 2 Prevalence of imposter syndrome by measurement instrument

Measurement Instrument	Ν	Sample size	l <sup>2</sup>	Begg and mazumdar correlation test	Prevalence (95%CI)
CIPS	25	9701	98.8	0.154	64.5 (95%Cl: 53.7-74.1)
YIS	4	1552	97.03	1.000	39.9 (95%Cl: 25.8-55.9)

<0.001) [46]. Bhardwaj et al. observed that participants with higher IS scores had lower self-esteem (P < 0.001) [58]. Alsaleem et al. found a positive correlation between low self-esteem and imposter syndrome (P < 0.0001) [52]. Finally, in the study by Neureiter et al., which included two population samples, imposter syndrome was

reinforced by low self-esteem in both groups (P < 0.001) [65] (Table 3).

Anxiety Anxiety is one of the factors associated with imposter syndrome (IS) that has been mentioned in several studies [41, 42, 45, 57, 58, 61, 67]. In the study by

## Table 3 The details of studies included in the review

Author	Year	Location	Population	Sample Size	Results
S Alrayyes et al. [51]	2020	Saudi Arabia	Young Adults	384	Results showed that there was a sta- tistical association between IS and gender ( $p < 0.01$ ), depression ( $p$ <0.001), stress ( $p < 0.001$ ), and all 3 domains of burnout ( $p < 0.01$ )
L Alsaleem et al. [52]	2021	Saudi Arabia	Medical Students	573	The results showed a positive cor- relation between low self-esteem and positive IS ( $P < 0.0001$ ). Also, among the socio-demographic characteristics, the only associa- tion found with IS was the gender of the student, which was statistically significant ( $P < 0.0001$ )
Z Alzufari et al. [29]	2020	United Arab Emirates	Medical Students	399	Among all the investigated char- acteristics, pure academic factors such as field of study ( $p = 0.001$ ), study phases ( $p = 0.032$ ), advisor's attitude ( $p = 0.029$ ), and comparison with peers' performance and grades ( $p = 0.024$ and $p < 0.001$ , respectively) exhibited the highest significant association with the severity of imposter syndrome
A R Anderson et al. [56]	2024	USA	Physical Therapists	514	Having management/supervisory experience (odds ratio (OR) = 0.55, 95% CI = 0.34–0.90) was associated with a reduced odds of IP presence. The results also showed that Holding a bachelor's or master's degree (vs. Doctor of Physical Therapy (DPT); OR = 2.31, 95% CI = 1.07–5.00), a his- tory of or current mental health diag- nosis (OR = 2.77, 95% CI = 1.69–4.54), and emotional exhaustion (moderate vs. low: OR = 5.37, 95% CI = 2.11–13.69; high vs. low: OR = 14.13, 95% CI = 5.56–35.89) were each associated with an increased odds of IS pres- ence
N S Bernard et al. [57]	2002	USA	Undergraduate Psychology Students	190	Correlation and regression analyses support the predicted relations of imposter measures with high neuroticism and low conscientious- ness. Facet-level correlations showed that depression and anxiety were particularly important characteris- tics of those with imposter feelings as well as Low self-discipline and perceived competence. ( $p < 0.001$ )
D Bhardwaj et al. [58]	2024	India	University Nursing Students	308	The results indicate that Nurses with with higher impostorism phenomenon had lower self-esteem ( $P < 0.001$ ) and higher anxiety ( $P < 0.001$ )
M A Carroll et al. [59]	2023	USA	Practicing Physical Therapists	422	The results showed a moderate negative correlation between age and CIPS, ( $r =36$ , $p < 0.001$ ). The results also showed a small positive relationship exists between the CIPS and the ambiguity tolerance scale, $r = 0.10$ , $p < 0.05$

# Table 3 (continued)

Author	Year	Location	Population	Sample Size	Results
DN Carvajal et al. [33]	2023	USA	Family Medicine	430	Inadequate mentorship ( $P < 0.05$ ) and poor professional belonging ( $P < 0.05$ ) were independently associ- ated with IS
S Deshmukh et al. [60]	2022	USA	Radiologists	30	The results showed There was sig- nificant ( $p = 0.024$ ) correlation between imposter phenomenon And burnout
A M El-Ashry et al. [61]	2024	Egypt	Nursing Students	1572	IS was positively correlated with depression, anxiety, and stress, and the total score of the Depres- sion Anxiety Stress scale ( $r = 0.639$ , p < 0.001)
M El-Setouhy et al. [53]	2024	Saudi Arabia	Medical Students	523	IS and self-esteem had negative correlation ( $p < 0.001$ ). The results also showed that several socio- demographic factors, including 2nd and 4 th-year students, forced Study choice, and a grade point average (GPA) of 3.0–3.49 ( $P < 0.05$ ), were associated with increased IS ( $P < 0.05$ ). Additionally, Paternal education Beyond high school was associated with lower IS ( $P < 0.05$ )
J Fenn et al. [62]	2024	India	Gamers	376	The results of this study showed a strong positive relationship between gaming addiction and the impostor phenomenon ( $p < 0.001$ ), with males presenting higher levels of gaming addiction and the Imposter phenomenon than females
H M Hutchins et al. [63]	2015	USA	Higher Education Faculty	61	Emotional exhaustion of faculty members was positively correlated with IS ( $p < 0.01$ ) and that faculty members who reported medium to high IS also reported greater use of adaptive coping skills to address imposter thoughts
L R Kogan et al. [64]	2020	USA	Veterinarians	941	Regression analysis in this study showed that residing in New Zealand (NZ) or the UK ( $p < 0.001$ ), being female or having been in practice for less than five years ( $p < 0.001$ ) increased the odds of having a high IS score
M LaPalme et al. [16]	2022	USA	Pre-service Educators	1643	IS was negatively associated with educator well-being ( $p < 0.001$ ). The study also showed that emo- tional regulation ability had a small negative correlation with Impostor thoughts ( $r = -0.05$ , $p = 0.03$ ). The results also showed that adap- tive coping strategies had a small negative correlation with imposter thoughts ( $r = -0.09$ , $p < 0.001$ )

## Table 3 (continued)

Author	Year	Location	Population	Sample Size	Results
L Z Macias-Moriarity et al. [36]	2023	USA	Female Pharmacy Faculty	380	The results of this study showed a significant negative correlation between IP scores and the Short GRIT Scale (GRIT-S) scores; meaning that faculty members who reported higher GRIT-S scores had lower IS ( $r = -0.40$ , $P < .001$ ). The study also showed that IP was correlated with job satisfaction, as faculty report- ing higher levels of IP reported lower job satisfaction ( $r = -0.31$ , $P < .001$ )
S F Mashhadi et al. [37]	2022	Pakistan	Medical Students	399	The results of this study showed a positive association between IS and gender ( $p < 0.001$ ), age ( $p < 0.001$ ), year of study ( $p < 0.001$ ), and aca- demic performance in class ( $p = 0.002$ ) among medical students with IS
M J Naser et al. [38]	2022	Bahrain	Medical Students	290	A strongly negative correlation between CIPS and RSES ( $r = -0.71$ , p < 0.001); with low self-esteem being a strong predictor of IP
A Neufeld et al. [39]	2023	Canada	Medical Students	277	Having an impersonal general causality orientation, more controlled motivation toward going to medical school, were associated with increased IP severity ( $p < 0.001$ ). The study also showed a negative association autonomy, competence, and relatedness satisfaction in the medical program and IP severity ( $p < 0.001$ )
M Neureiter et al. [65]	2016	Austria	University students and working professionals	322	In both study samples, both univer- sity students and working profes- sionals in universities, impostor feelings were fostered by fear of failure ( $p < 0.001$ ), fear of success ( $p < 0.001$ ), and low self-esteem ( $p < 0.001$ ), but was reduced by career planning ( $p = 0.001$ ), career striving ( $p = 0.048$ ), and the motivation to lead ( $p = 0.005$ ). The results also showed that IS had the most negative impact on career planning and career striv- ing in students and on the motiva- tion to lead in working professionals
M Opara et al. [66]	2023	Slovenia	Physiotherapy Students	106	A small but statistically significant negative correlation ( $r = -0.20$ , p = 0.039) between age and CIPS category, This indicates that higher student age is associated with smaller degree of IS. Similarly, the study showed a small negative correlation but statistically significant ( $r = -0.19$ , $p = 0.048$ ) between year of study and CIPS category, which indicates that higher year of study is also associated with smaller degree of IS. Additionally, a statisti- cally significant negative correlation was found between clinical work experience classification and CIPS category ( $r = -0.34$ ; $p < 0.001$ ), as well as between clinical work experience category and the total CIPS score ( $r = -0.31$ ; $p < 0.001$ )

# Table 3 (continued)

Author	Year	Location	Population	Sample Size	Results
K Oriel et al. [41]	2004	USA	Family Medicine Residents	185	IS scores had a correlation with depressive symptoms ( $r^2$ =.45, $P < 0.0001$ ), trait anxiety ( $r^2$ =.65, $P < 0.0001$ ), and state anxiety ( $r^2$ =.39, $P < 0.0001$ ). The study also showed that individuals with the highest IS scores had the lowest self-esteem on the Rosenberg Self-Esteem Scale ( $r^2$ =63, $P$ <.0001)
S Rosenthal et al. [42]	2021	USA	Medical Students	257	Students with higher IP scores had significantly lower mean scores on self-compassion, sociability self-esteem ( $P <$ .0001 for all), getting along with peers ( $P =$ .03). Lower IS scores were associated with lower average scores in neuroticism/anxiety and loneliness ( $P <$ .001 for both)
B M Samur et al. [43]	2024	Turkey	Paediatric Residents	113	The analysis also revealed a signifi- cant correlation and a monotonic- linear trend between IP scores and the decision-making process, even after excluding the unsuccess- ful participants ( $P < .001$ )
P Shinawatra et al. [45]	2023	Thailand	Undergraduate Clinical Medical Students	228	The results from the multivariable analysis showed that high levels of stress (adjusted odds ratio = 2.315; 95% confidence interval = 1.105– 4.853), anxiety (6.462; 1.374–30.392), and depression (4.219; 1.448–12.290) were significantly associated with an increased risk of experienc- ing the impostor phenomenon
R A Siraj et al. [46]	2024	Saudi Arabia	Respiratory Therapy (RT) Students	901	There was a significant association between Impostor Syndrome and low self-esteem ( $p < 0.001$ ). Other factors associated with IS in this study included family income ( $P < 0.005$ ), parents' education ( $P < 0.005$ ), quitting intention ( $P < 0.005$ ), and having been diagnosed with psychological disorders ( $P < 0.005$ )
A J W Takaoka et al. [67]	2024	Netherlands	Software Engineers	224	Happiness, depression, and anxiety had a high positive correlation with IS ( $r$ (203) = 0.85, $p < 0.0001$ ). The study also showed a negative correlation between mental health literacy and IS, happiness, anxiety, and depression
M Vidanapathirana et al. [48]	2024	Sri Lanka	Medical and Surgical Postgraduate Trainees	201	The study results showed sig- nificant associations between IP and sociodemographic factors such as being single, lack of friendships outside medicine and improvement in financial status related to medical profession, and improved financial status related to the medical profes- sion ( $p < 0.05$ ); academic factors such as satisfaction with pursuing post- graduate training and satisfaction with academic performance ( $p < 0.05$ ); work-related factors such as early stages of postgraduate training, lack of confi- dence in communicating with superiors and other specialties, receiving criticism from the team and sense of guilt regarding patient outcomes ( $p < 0.05$ )

El-Ashry et al., imposter syndrome (IS) was positively correlated with anxiety and the total score of the anxiety scale (r = 0.639, p < 0.001) [61]. In the study by Oriel et al., imposter syndrome (IS) was highly correlated with anxiety (P < 0.0001) [41]. In a study by Rosenthal et al., conducted among medical students, low scores on the Imposter Syndrome (IS) were associated with low mean scores on anxiety (P < 0.001) [42]. In a study by Takaoka et al., conducted among 224 participants, a positive correlation was identified between the Imposter Syndrome (IS) and anxiety (P < 0.0001) [67]. Participants with higher Imposter Syndrome (IS) in the study by Bhardwaj et al., had higher anxiety (P < 0.001) [58]. Surface correlations in the study by Bernard et al., indicated that anxiety was an important characteristic of individuals with the Imposter Syndrome (IS) (P < 0.001) [57]. The results of multivariate analysis in the study by Shinawatra et al., indicated that high levels of anxiety (6.462; 1.374-30.392) were significantly associated with an increased risk of experiencing the Imposter Syndrome (IS) [45] (Table 3).

*Depression* Depression is another factor associated with imposter syndrome (IS) that has been mentioned in a large number of studies [41, 45, 51, 57, 61, 67]. Alrayyes et al. found a statistical relationship between IS and depression in their study (p < 0.001) [51]. Surface correlations in the study of Bernard et al. showed that depression is an important characteristic of people with imposter syndrome (IS) (p < 0.001) [57]. In the study of El-Ashry et al., imposter syndrome (IS) was positively correlated with depression and the total score of the depression scale (r = 0.639, p < 0.001 [61]. In the study of Oriel et al., imposter syndrome (IS) was significantly associated with depression (P <0.0001) [41]. Moreover, in the study of Takaoka et al., a positive correlation was identified between imposter syndrome (IS) and depression (p < 0.0001) [67]. Multivariate analysis results in the study by P Shinawatra.et al., showed that high levels of depression (4.219; 1.448-12.290) were significantly associated with an increased risk of experiencing imposter syndrome (IS) [45] (Table 3).

*Stress* Stress is another factor associated with imposter syndrome (IS) that has been mentioned in three studies [45, 51, 61]. Multivariate analysis results in the study by Shinawatra.et al., showed that high levels of stress (adjusted odds ratio =2.315; 95% confidence interval =1.105–4.853) were significantly associated with an increased risk of experiencing imposter syndrome (IS) [45]. Alrayyes.et al. found a statistical relationship between IS and stress (p < 0.001) [51]. In the study by El-Ashry et al., imposter syndrome (IS) was positively correlated with stress and total stress scale score (r = 0.639, p < 0.001) [61] (Table 3).

*Burnout* Impostor syndrome (IS) can lead individuals to burnout; a state of fatigue and apathy resulting from a mismatch between the individual's job demands and the resources available to manage them. In this regard, two articles have pointed out the relationship between these two variables [51, 60]. Alrayyes et al. found a statistical relationship between imposter syndrome (IS) and all three areas of burnout (p < 0.01) [51]. Deshmukh et al., in another study that examined imposter syndrome (IS) in radiologists and evaluated its correlation with burnout in them, concluded that there is a significant correlation (p = 0.024) between these two [60] (Table 3).

*Age* Three studies have examined the association of age with imposter syndrome (IS) [37, 59, 66]. In the study by Opara et al., there was a small (r = -0.20), but statistically significant (p = 0.039) negative correlation between age and CIPS category. This suggests that higher student age is associated with lower levels of imposter syndrome (IS) [66]. In another study by Mashhadi et al., there was a positive correlation between imposter syndrome (IS) and age (p < 0.001) of participants [37]. In the study by Carroll et al., there was a moderate negative correlation between age and CIPS (r = -0.36, p < 0.001) [59] (Table 3).

*Gender* Gender is another factor that has been associated with imposter syndrome (IS) [37, 51, 52]. Alrayyes. et al. in their study found a statistical association between imposter syndrome (IS) and gender (p < 0.01) [51]. Alsaleem.et al. also found a significant association (P < 0.0001) between imposter syndrome (IS) and gender [52]. In another study conducted by Mashhadi.et al., there was a positive association between imposter syndrome (IS) and gender (p < 0.001) of the participants (Table 3).

## **Other factors**

Academic year [37, 66], tolerance of ambiguity [59], inadequate mentorship [33], poor professional belonging [33], emotional exhaustion [56, 63], well-being [16], ability to regulate emotions [16], adaptive coping strategies [16], grit [36], job satisfaction [36], academic performance [37], clinical work experience [66], self-compassion [42], sociability self-esteem [42], getting along with peers [42], loneliness [42], decision-making process [43], family income [46], parents' education [46], quitting intention [46], having been diagnosed with psychological disorders [46], happiness [67], sociodemographic factors [48], academic factors [48], work-related factors [48], low self-discipline [57], fear of failure [65], fear of success [65], career planning [65], motivation to lead [65], career striving [65], field of study [29], study phases [29], advisor's attitude [29], comparison with peers' performance and grades [29],

being 2nd and 4th-year students [53], forced study choice [53], grade point average (GPA) of 3.0–3.49 [53], Paternal education beyond high school [53], Having an impersonal general causality orientation [39], more controlled motivation toward going to medical school [39], lower need satisfaction in the medical program [39], Having manager/supervisor experience [56], a history of or current mental health diagnosis [56], and gaming addiction [62] are among other factors that may be related to imposter syndrome (Table 3).

## Discussion

Imposterism, also known as imposter syndrome or imposter phenomenon, is an emerging phenomenon that has gained increasing attention in recent years, particularly among high-achieving individuals. Its identification often overlaps with symptoms such as anxiety, depression, burnout, and stress. In the present meta-analysis and systematic review which was aimed at determining the global prevalence of IS, the overall prevalence of the syndrome was found to be 62.1%, which indicates a relatively high prevalence of IS globally. Also, in this study, based on meta-regression testing, it was reported that the prevalence of imposter syndrome increases with the increase in the number of years of study, indicating greater attention to this syndrome and an increase in studies in recent years.

It is estimated that three-quarters of all individuals will be affected by Imposterism at some point in their lives [68]. Accordingly, our findings are comparable to those of a study conducted among dental students in the midwestern United States, which found that 58.3% of respondents had levels of IS above the clinical threshold and experienced significant impact of imposter syndrome on their professional, personal, and academic lives [69]. In other studies, among medical students in Oman, the United Arab Emirates, Saudi Arabia, Pakistan, Bahrain, Canada, and the United States, the prevalence of IS ranged from 41.81% to 89.5% [27, 29, 34, 37-39, 42]. In addition to those in the medical sciences, the syndrome is also present to some extent in nonmedical settings. In one study, the prevalence of IS among pre-service teachers was reported as 93.4% [16]. Similarly, the prevalence of IS among research and academic librarians was 15%; this is approximately three times lower than the prevalence found among medical students [15]. In another study, the prevalence of the syndrome was 35% among engineering students [70]. A possible explanation for this difference in prevalence between medical and non-medical populations could be that medical students are typically perceived as successful individuals in many societies, which puts them under constant pressure and stress [71].

The prevalence of IS depends largely on the screening tools and threshold values used to examine IS symptoms. According to the results presented in Table 2, which reports the prevalence of IS by measurement instrument, the highest prevalence was reported by the CIPS tool with a prevalence of 66.4% (95% CI: 55.3–76) and the YIS tool with a prevalence of 39.9% (95%CI: 25.8–55.9) (Table 2).

Some studies have used the CIPS instrument, which considers a score of less than 40 as no IS; a score of 40 to 59 as mild IS; a score of 60 to 79 as moderate IS; and a score of more than 80 as severe IS [72]. Some authors suggest using a score of 62 as a cutoff value on the CIPS scale, while others suggest using the mean CIPS score in the study sample to distinguish between IS and non-IS sufferers [73]. In the present study, self-esteem was identified as an important associated factor in individuals with IS, such that individuals with higher CIPS scores had lower self-esteem. This finding provided sufficient grounds for the conclusion that self-esteem is an important predictor leading to high IS. Accordingly, the study by Bhardwaj et al. confirms our findings [58]. Other factors such as anxiety, depression, stress, and even burnout can also influence the tendency to engage in IS; for instance, medical students in higher education and those who strive to achieve more are more prone to depression, anxiety, stress, and burnout. Many studies, including El-Ashry et al.'s work confirm this insight **[61**].

Since research in this area is ongoing, no systematic review with meta-analysis has yet summarized the results on the prevalence of IS among the general population. This systematic review and meta-analysis aimed to gather empirical evidence and pool the prevalence of IS. The results of the study provide further nuanced insights related to this significant global issue and can inform public health policies. Promoting awareness of mental health and embracing and nurturing supportive environments for individuals can help reduce IS and improve the quality of work and educational settings.

## Limitations

The most important limitation of the present study was the lack of prevalence reporting in some of the reviewed studies or incomplete reporting of information in the studies, which led to these studies being excluded from the final review and not included in the meta-analysis. Also, due to the high heterogeneity in reporting in examining factors associated with the prevalence of IS, meta-analysis was not possible. Another limitation of the present study is the significant publication bias in the reviewed studies.

## Conclusion

The results of this study showed that the prevalence of IS is relatively high worldwide and is associated with self-esteem, anxiety, depression, stress, and burnout. However, due to high heterogeneity, the results should be interpreted with caution. Moreover, the results of this study can be used by policymakers and help identify the psychological and social needs of affected individuals in order to design and develop support and social programs to prevent IS. These insights can lead to the development of educational and counseling strategies and interventions that aim to reduce negative emotions caused by this syndrome and promote mental health in educational and work environments.

#### Abbreviations

IS	Imposter Syndrome
YIS	Young Impostor Scale
CIPS	The Clance Impostor Phenomenon Scale
STROBE	The Strengthening the Reporting of Observational Studies ir
	Epidemiology
PRISMA	The Preferred Reporting Items for Systematic Reviews and Meta-Analyses

PRISMA The Preferred Reporting Items for Systematic Reviews and Meta-Analyse:

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#### Authors' contributions

NS and HRH and MM contributed to the design, MM statistical analysis, and participated in most of the study steps. MM and AHF and ARF and PH prepared the manuscript. MM and AHF and HRH and SR and PH assisted in designing the study, and helped in the, interpretation of the study. All authors have read and approved the content of the manuscript.

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#### Data availability

Datasets are available through the corresponding author upon reasonable request.

## Declarations

#### Ethics approval and consent to participate

Ethics approval was received from the ethics committee of deputy of research and technology, Kermanshah University of Medical Sciences (50005516).

#### **Consent for publication**

Not applicable.

#### **Competing interests**

The authors declare no competing interests.

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