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Type D Personality in Adults with Inborn Errors of Immunity: Prevalence and Psychosocial Associations

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ABSTRACT

Objective: Type D personality, characterized by negative affectivity and social inhibition, has been associated with increased psychological distress and reduced quality of life in individuals with chronic illnesses. This study aimed to determine the prevalence of Type D personality and examine its psychosocial correlates in adults diagnosed with inborn errors of immunity (IEI).

Materials and Methods: This descriptive, cross-sectional study included 53 adult patients with IEI. Sociodemographic, clinical, and psychosocial data were collected using a structured patient identification form. Type D personality was assessed using the validated Turkish version of the Type D Scale-14 (DS14). Group comparisons were performed using appropriate statistical tests.

Results: Type D personality was identified in 22.6% of participants (n = 12). It was more prevalent among women (27.6%) than men (16.7%) (p = 0.344). Higher rates were observed among divorced (42.9%) and single (35.3%) participants compared to married individuals (10.3%) (p = 0.062), among unemployed (32.1%) versus employed participants (12.0%) (p = 0.080), and among those reporting nicotine and/or alcohol use (33.3%) compared to non-users (11.5%) (p = 0.099). Participants with a psychiatric diagnosis had significantly higher rates of Type D personality compared to those without (57.1% vs. 17.4%, p = 0.039). No significant associations were identified with clinical parameters.

Conclusion: In this cohort of adult patients with IEI, the prevalence of Type D personality was comparable to that reported in general population samples, but significantly higher among individuals with a psychiatric diagnosis, suggesting a potential link between Type D traits and psychological vulnerability in this group.

Keywords: Type D personality, inborn errors of immunity, psychological comorbidity, DS14, chronic disease

INTRODUCTION

Inborn errors of immunity (IEI) are a group of genetic disorders characterized by impaired development or function of the immune system, presenting with heterogeneous clinical manifestations. In recent years, the implementation of next-generation sequencing technologies has enhanced early diagnostic capabilities (1). In parallel, advances in therapeutic strategies—including immunoglobulin replacement, biologic agents, hematopoietic stem cell transplantation, and gene therapy—have significantly improved the life expectancy of affected individuals. However, patients with IEI continue to experience recurrent infections, progressive organ dysfunction, and frequent

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hospitalizations. These complications interfere with educational continuity, restrict occupational participation, and limit opportunities for social engagement. This multifaceted burden contributes to a notable increase in anxiety, depression, and difficulties in social adaptation. Health-related quality of life scores in IEI patients are also significantly lower than those of individuals with other chronic diseases or healthy populations (2,3).

Personality traits, particularly Type D personality, are increasingly recognized as important determinants of psychological and clinical outcomes in chronic diseases (4,5). Type D personality (also known as "distressed personality") is a personality construct characterized by the co-occurrence and stability of two core traits: negative affectivity (e.g., chronic worry, pessimism, low self-efficacy) and social inhibition (e.g., suppression of emotional expression and social withdrawal). This personality type has been shown to carry clinical significance due to its associations with adverse health outcomes (6,7). Although not formally classified in the DSM-5-TR, it is conceptually included under the dimensional model of personality traits, especially "negative affectivity" and "detachment" (8). In the ICD-11 framework, it is not defined as a formal disorder but is acknowledged within the context of "temperamental traits." Despite this, it is recognized as a clinically relevant personality variant due to its impact on health outcomes (9). Type D personality has been associated with increased mortality, poor prognosis, and reduced quality of life in individuals with chronic diseases such as coronary artery disease (10). In a study conducted among healthy adults in Turkey, the prevalence of Type D personality was found to be 31.7%, whereas global estimates have ranged from 16% to 38.5% (11–13). Furthermore, the Type D Scale-14 (DS14) has been validated in various cultural settings—including Taiwan, South Korea, Poland, Ukraine, and Turkey — demonstrating its cross-cultural applicability and psychometric reliability (11,14,15).

Individuals with Type D personality are at significantly higher risk for a range of psychiatric and physical symptoms. These include increased emotional distress, lower treatment adherence, and poorer quality of life, all of which may exacerbate disease severity (16–21). Advances in psychoneuroimmunology have highlighted the biological underpinnings of these outcomes, such as chronic activation of the hypothalamic–pituitary–adrenal axis and elevated proinflammatory cytokines (22). Additionally, immune profiles observed in depression studies show increased CD4+ T helper cells, reduced CD8+ T suppressor cells, and elevated CD4/CD8 ratios in people with Type D traits contributing to proinflammatory shifts (23,24). In patients with underlying immune deficiencies, such changes may further aggravate immunologic imbalance. Thus, the role of psychological stress and personality traits in modulating immune responses and disease course in IEI populations warrants further investigation.

Accordingly, the aim of this study was to determine the prevalence of Type D personality in adults diagnosed with IEI and to evaluate its association with sociodemographic, clinical, and psychosocial variables. This study sought to clarify whether Type D personality is disproportionately represented in this patient group and to identify potential psychological vulnerabilities that may warrant integrated mental health support in the management of IEI.

MATERIAL and METHODS

This cross-sectional observational study included 53 adult patients diagnosed with IEI who presented to the Immunodeficiency Outpatient Clinic of the Department of Clinical Immunology and Allergy at Ege University Faculty of Medicine between March and September 2024. Patients were recruited consecutively during routine follow-up visits within this six-month period. Inclusion criteria comprised being 18 years of age or older, having a confirmed diagnosis of IEI according to established clinical and immunological criteria (25), receiving immunoglobulin replacement therapy for at least six months, and being literate in Turkish to ensure valid self-reporting in questionnaire-based assessments. Patients who had newly initiated treatment within the past six months, as well as those with cognitive impairment or who declined participation, were excluded from the study. All participants were informed that participation was entirely voluntary, and that refusal or withdrawal would not affect the medical care they routinely received. Prior to data collection, participants received verbal and written information about the study's purpose, procedures, potential risks, and benefits, and provided informed consent. The study protocol was approved by the Ege University Clinical Research Ethics Committee (approval number: 24-3.1T/41) and was conducted in accordance with the principles of the Declaration of Helsinki.

Given the rarity of IEI, a formal power analysis was not feasible. Therefore, the final sample size of 53 participants

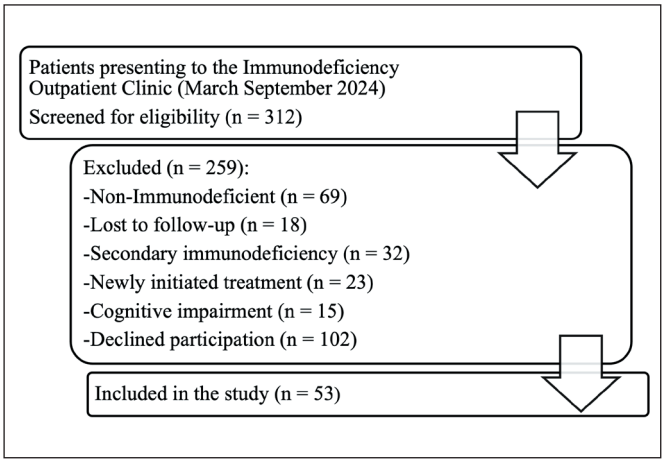

Figure 1: Flowchart of Participant Recruitment and Inclusion.

represents the maximum number of eligible patients who could be enrolled during the study period at a tertiary referral center. This approach is consistent with methodological standards in rare disease research, as shown in Figure 1.

Data Collection Tools

Data were collected through face-to-face interviews conducted by trained healthcare professionals using two structured instruments specifically designed for the purposes of this study: the Patient Identification Form and the Type D Personality Scale.

Patient Identification Form

This form was developed by the research team to collect comprehensive sociodemographic and clinical information from each participant. It includes variables such as age, sex, marital status, education level, employment status, perceived income level, number of children, and place of residence, as well as clinical data including age at diagnosis of IEI, disease subtype (if applicable), type of immunoglobulin therapy (Intravenous immunoglobulin (IVIG), subcutaneous immunoglobulin (SCIG)), history of hospitalizations related to the disease, comorbid medical conditions (e.g., autoimmune diseases, malignancies), concomitant medication use, and psychiatric history. In addition, patients were asked to indicate the frequency of their current Immunoglobulin replacement therapy (IgRT) schedule (e.g., weekly, every 3, 4, or 8 weeks, or irregular) to approximate treatment adherence. Patients receiving IVIG at monthly intervals (e.g., every 4 weeks), outside of standard clinical practice, were categorized as nonadherent. This variable was included to assess potential associations with Type D personality. These data were used to explore potential sociodemographic and clinical correlates of Type D personality in individuals with IEI.

Psychiatric diagnoses were not established through structured clinical interviews or psychiatric examinations; rather, they were based on participants' self-reported history of receiving a diagnosis from a licensed psychiatrist or psychologist.

Type D Personality Scale

The Type D Personality Scale (DS14) was developed by Denollet in 2005 to assess two core traits: Negative Affectivity (NA) and Social Inhibition (SI). The Turkish version, validated by Öncü and Köksoy Vayısoğlu, has demonstrated strong psychometric properties in chronic illness populations (11,14). The Turkish version of the DS14 has demonstrated high internal consistency, with Cronbach's alpha values of 0.85 for the Negative Affectivity subscale and 0.76 for the Social Inhibition subscale. Test–retest reliability coefficients over a four-week interval were 0.75 and 0.77, respectively, confirming the scale's reliability for use in Turkish populations. The scale consists of 14 self-report items, with 7 items for each subscale, rated on a 5-point Likert scale (0 = false, 4 = true); items 1 and 3 are reverse-scored. Individuals scoring ≥10 on both subscales are classified as having a Type D personality. In this study, participants completed the scale independently, with the interviewer present only to clarify questions if needed.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics version 25.0. Descriptive statistics were used to summarize demographic and clinical characteristics. Categorical variables were compared using Pearson's chi-square or Fisher's exact test, as appropriate. Continuous variables were evaluated using the independent-samples t-test for normally distributed data and the Mann–Whitney U test for non-normally distributed data. Statistical significance was set at $p < 0.05$ for all analyses.

RESULTS

A total of 53 patients were included in the study. The mean age was 40.98 ± 14.88 years (median: 37, range: 20–91). Among the participants, 29 (54.7%) were female. The majority were married (n = 29, 54.7%), residing in urban areas (n = 48, 90.6%), and had university-level edu-

cation (n = 35, 66.0%). While 25 (47.2%) were employed, 28 (52.8%) were not working, with 9 (17.0%) reporting illness as the primary reason for unemployment. In terms of socioeconomic status, 31 (58.5%) reported income equal to expenses, whereas 16 (30.2%) had income less than expenses. 28 (52.8%) used public transportation to access the hospital. The vast majority of participants (n = 51, 96.2%) lived in nuclear families.

Regarding clinical characteristics, 11 patients (20.8%) had been diagnosed with IEI before the age of 18. Forty-seven patients (88.7%) were receiving IVIG therapy, and six patients (11.3%) were on SCIG. Among SCIG recipients, all six reported weekly administration, including one patient following a four-week interval. Of those receiving IVIG (n = 47), 34 patients (64.2%) were treated every three weeks, while 13 patients (24.5%) reported monthly administration (every 4 weeks). This variable was used to approximate treatment adherence and explore associations with Type D personality. Although monthly infusions are not routinely recommended, these deviations were categorized as nonadherence (n = 13, 24.5%). The analysis did not reveal any statistically significant relationship between Type D personality and either treatment interval or inferred adherence ($p > 0.99$). Treatment satisfaction was high, with 52 participants (98.1%) expressing satisfaction with their current therapy. A psychiatric diagnosis was reported in 13.2% of participants (n = 7), most commonly depression (n = 5) and anxiety disorder (n = 1); one participant did not specify the diagnosis. Additionally, 22 patients (41.5%) had a history of allergic disease, and 33 patients (62.3%) reported at least one comorbid condition. Regarding family history, 6 participants (11.3%) reported a history of immunodeficiency, 11 participants (20.8%) had a history of infant death in the family, and 16 participants (30.2%) reported consanguinity. The mean NA score was 9.3±6.2 and SI score was 8.1±5.7 among the participants, with higher values observed in those with Type D personality. Additional findings regarding sociodemographic, clinical, and psychosocial variables are presented in Table I.

Total of 12 participants (22.6%) were identified as having Type D personality. The prevalence was 27.6% (n = 8/29) among women and 16.7% (n = 4/24) among men; however, this sex difference was not statistically significant ($p = 0.344$). Type D personality was observed in 6 of 17 single participants (35.3%), 3 of 29 married participants (10.3%), and 3 of 7 divorced participants (42.9%). Although the prevalence was highest among divorced individuals, this association did not reach statistical significance ($p = 0.062$). Similarly, Type D personality was more common among participants who reported nicotine and/or alcohol use (4 of 12; 33.3%) compared to non-users (8 of 41; 19.5%), and among non-working individuals (9 of 28; 32.1%) compared to those who were employed (3 of 25; 12.0%). These differences also failed to reach statistical significance ($p = 0.099$ and $p = 0.080$, respectively). A statistically significant association was found between having a psychiatric diagnosis and Type D personality. Among those with a psychiatric diagnosis (n = 7), 4 participants (57.1%) were classified as having Type D personality, compared to 8 of 46 (17.4%) among those without such a diagnosis ($p = 0.039$). No statistically significant associations were observed between Type D personality and educational level, place of residence, income status, history of hospitalization, family structure, treatment satisfaction, presence of comorbidities or allergies, disability-related applications, route of immunoglobulin administration, age at diagnosis, consanguineous marriage or family history variables such as infant death, immunodeficiency,. Detailed distributions are presented in Table II.

DISCUSSION

To our knowledge, this is the first study to evaluate the prevalence of Type D personality among patients with IEI. The observed rate of 22.6% falls within the range reported in general population studies (typically 16%–38.5%) and does not suggest a marked increase in psychological vulnerability (11–13). Importantly, the only statistically significant association was identified in individuals with a history of psychiatric diagnosis. This underscores the relevance of evaluating psychiatric comorbidities when Type D traits are detected and highlights the potential value of routine psychological assessment in the care of IEI patients.

Reviews and systematic studies consistently demonstrate that Type D personality is more prevalent among patients with chronic conditions such as diabetes, cardiovascular diseases, and dermatological disorders compared to healthy controls (4,5,26,27). Moreover, the prevalence of Type D personality has been reported to vary significantly across different medical conditions. For instance, it has been documented as 23% in patients with implantable cardioverter-defibrillators, 26.1% in those with coronary heart disease, 27.7% among individuals undergoing he-

Table I: Sociodemographic Characteristics of the study group (N=53)

Characteristic	Value	Characteristic	Value
Sex, n (%)		Family structure, n (%)	
Female	29 (54.7)	Nuclear	51 (96.2)
Male	24 (45.3)	Extended	2 (3.8)
Age (years) median (IQR; min–max)	37 (19;20-91)	BMI (kg/m²) median (IQR; min–max)	23.39 (23;15.2-46)
Age at Diagnosis (years) median (IQR; min–max)	28 (6.98;4-69)	Days of Hospitalization median (IQR; min–max)	17.50 (17;1-150)
Marital status, n (%)		Substance use, n (%)	
Single	17 (32.1)	Smoking	15 (28.3)
Married	29 (54.7)	Alcohol	6 (11.3)
Divorced	7 (13.2)	None	26 (49.1)
		Both	6 (11.3)
Place of residence, n (%)		Psychiatric diagnosis, n (%)	
Town	5 (9.4)	Yes	7 (13.2)
City	48 (90.6)	No	46 (86.8)
Education, n (%)		Diagnosis type, n (%)	
Primary	9 (17.0)	Anxiety disorder	1 (16.7)
High school	9 (17.0)	Depression	5 (83.3)
University	35 (66.0)		
Employment, n (%)		Hospitalization, n (%)	
Unemployed	28 (52.8)	Yes	30 (56.6)
Employed	25 (47.2)	No	23 (43.4)
Reason for unemployment, n (%)		Treatment, n (%)	
Illness	9 (90.0)	IVIG	47 (88.7)
No job available	1 (10.0)	SCIG	6 (11.3)
Income Level, n (%)		Treatment satisfaction, n (%)	
Income < Expenses	16 (30.2)	Yes	52 (98.1)
Income = Expenses	31 (58.5)	No	1 (1.9)
Income > Expenses	6 (11.3)		
NA Score		SI Score	
mean ± SD	9.32±8.01	mean ± SD	7.06±5.78
median (IQR; min–max)	8 (13.5;0-28)	median (IQR; min–max)	6 (9;0-23)

BMI: Body Mass Index, **IQR:** Interquartile Range, **NA:** Negative Affectivity, **SI:** Social Inhibition.
Values are presented as mean ± SD or median (IQR; min–max) based on distribution. Appropriate statistical tests were applied as indicated.

modialysis, 33% in patients with asthma, and as high as 70.8% in those diagnosed with irritable bowel syndrome (18,28–31). These findings suggest that Type D personality is shaped not only by the presence or severity of chronic illness but also by individual psychological responses such as illness perception, perceived controllability, and coping mechanisms. Taken together, our findings suggest that IEI may not be associated with heightened expression of Type D personality traits, at least not to the extent observed in other chronic illness populations. Nevertheless, further studies with larger and more diverse samples may be needed to better elucidate the relationship between IEI and Type D personality traits.

In our study, the prevalence of Type D personality was found to be significantly higher among individuals with a history of psychiatric diagnosis compared to those without (57.1% vs. 17.4%; p = 0.039), supporting the strong link between this personality construct and psychological vulnerability. However, only 7 participants reported such a diagnosis, limiting the feasibility of conducting reliable multivariate regression analyses. Including such a small number of events in a regression model would increase the risk of statistical overfitting and compromise the robustness of the results. Therefore, this association was interpreted as exploratory rather than causal. In the literature, Type D personality—defined by the co-occurrence of NA and SI—has been consistently associated with depression,

Table II: Comparison of Sociodemographic, Clinical, and Psychological Variables by Type D Personality Status

Variable	Non-Type D	Type D	p-value	Test Statistic
Age (years) Med [min- max]	38 [21-91]	35 [20-69]	0.206	U = 186.5
BMI (kg/m²) Med [min- max]	23.39 [15.24-45.99]	23.93 [17.51-40.4]	0.503	U = 227.5
Comorbidity Count Med [min- max]	2 [1-6]	2 [1-6]	0.786	U = 247.0
Sex, n (%)				
Female	21 (51.2)	8 (66.7)	0.344	$\chi^2 = 0.89$
Male	20(83.3)	4 (16.7)		
Place of residence, n (%)				
Town	5(12.2)	0	0.331	$\chi^2 = 0.95$
City	36 (87.8)	12(100)		
Employment, n (%)				
Unemployed	19 (46.3)	9 (75)	0.080	$\chi^2 = 3.05$
Employed	22 (53.7)	3 (25)		
Substance use, n (%)				
No	23 (56.1)	3 (25)	0.099	$\chi^2 = 2.73$
Yes	18 (43.9)	9 (75)		
Hospitalization, n (%)				
Yes	22 (53.7)	8 (66.7)	0.323	$\chi^2 = 0.97$
No	19 (46.3)	4 (33.3)		
Comorbidity status, n (%)				
No	14 (34.1)	5 (41.7)	0.736	$\chi^2 = 0.11$
Yes	27 (65.9)	7 (58.3)		
Consanguinity, n (%)				
Yes	13 (31.7)	3 (30.2)	0.737	$\chi^2 = 0.00$
No	28 (68.3)	9 (75)		
Age at Diagnosis (years) Med [min- maxmaks]	30.61±15.46	26 [6-55]	0.552	U = 231.0
Initial Symptom (yes). n %) Med [min- max]	26 [3-69]	16 [1-47]	0.126	U = 175.5
Days of Hospitalization				
Mean ± SD	20 [1-150]	14 [2-30]	0.423	U = 180.0
Med [min- max]				
Marital status, n (%)				
Single	11(26.8)	6 (50)		
Married	26 (63.4)	3 (25)	0.062	$\chi^2 = 5.69$
Divorced	4 (9.8)	3 (25)		
Education, n (%)				
Primary	6 (14.6)	3 (25)		
High school	8 (19.5)	1 (8.3)	0.562	$\chi^2 = 1.16$
University	27 (65.9)	8 (66.7)		
Income level, n (%)				
Income < Expenses	11(26.8)	5 (41.7)		
Income = Expenses	24 (58.5)	7 (58.3)	0.359	$\chi^2 = 2.05$
Income > Expenses	6 (14.6)	0		
Psychiatric diagnosis, n (%)				
Yes	3 (7.3)	4 (33.3)	0.039	$\chi^2 = 4.24$
No	38 (92.7)	8 (66.7)		
Treatment, n (%)				
IVIG	36 (87.8)	11 (91.7)	1.000	Fisher's exact
SCIG	5 (12.2)	1 (8.3)		
Treatment satisfaction, n (%)				
Yes	41 (100)	11 (91.7)	0.226	Fisher's exact
No	0	1 (8.3)		
Family hx of IEI, n(%				
Yes	6 (14.6)	0	0.317	$\chi^2 = 1.00$
No	35 (85.4)	12 (100)		

BMI: Body Mass Index, **χ^2:** Chi-square test; **U:** Mann-Whitney U test; **t:** Independent-samples t-test.

Appropriate tests were used based on data distribution. $p < 0.05$ was considered statistically significant.

anxiety, post-traumatic stress disorder, and general psychological distress (32–35). Multiple studies have reported significantly higher rates of psychiatric diagnoses among individuals with Type D personality and have proposed that this trait may act as a vulnerability factor for psychological disorders (32–34,36). Although Type D personality shares overlapping characteristics with depression and anxiety, it is considered a psychometrically distinct construct (36). For this reason, it has been recommended that Type D personality be considered both as an indicator of susceptibility to psychiatric comorbidities and as a specific psychological characteristic suitable for use in clinical screening (36,37). Especially in populations with elevated psychiatric comorbidity—such as patients with chronic illnesses or immune disorders—systematic assessment of Type D personality may help identify individuals at greater psychological risk and inform comprehensive care planning.

No significant associations were found between Type D personality and most sociodemographic or clinical variables, including immunoglobulin therapy characteristics. This finding may suggest that in a patient group with high treatment satisfaction and widely regular therapy administration, the link between psychological vulnerability and clinical factors could be limited. Nonetheless, several non-significant trends were identified—for instance, higher prevalence among women, single or divorced individuals, and those reporting substance use—which may attain statistical significance in studies with larger and more heterogeneous samples. Furthermore, the composition of our sample—primarily consisting of individuals residing in urban areas with relatively high educational attainment and consistent access to care—may reflect a psychologically resilient patient group. Consequently, this homogeneity might have attenuated the detectability of potential associations.

Indeed, the literature suggests that sociodemographic variables have a limited and inconsistent impact on the distribution of Type D personality traits, whereas genetic predisposition and individual-specific environmental experiences appear to be considerably more influential (38,39). The heritability estimates for NA and SI have been reported to range between 34% and 52%, indicating a substantial genetic basis for the long-term stability of this personality construct. Although specific environmental exposures—such as stressful life events, early-life adversity, or personal trauma—may contribute to the development of Type D traits over time, shared environmental influences (e.g., family structure, socioeconomic status) have not been shown to exert a significant effect. Furthermore, Type D personality has been reliably assessed using culturally adapted, validated instruments across diverse populations, indicating high cross-cultural consistency. Taken collectively, these findings suggest that Type D personality is a trait largely independent of demographic variables, and is instead shaped by a combination of biological vulnerability and individual psychological fragility.

This study is among the first to evaluate the prevalence of Type D personality in adults diagnosed with IEI and is strengthened by the systematic assessment of sociodemographic, clinical, and psychiatric variables using a culturally validated instrument (DS14). These features enhance the internal validity and comparability of our findings with existing literature. However, several limitations must be acknowledged. The relatively small sample size and the limited number of participants reporting a psychiatric diagnosis restricted the statistical power and precluded more complex analyses such as multivariate regression. The sociodemographically homogeneous profile of participants and the reliance on self-reported data may also limit generalizability and introduce reporting bias. The cross-sectional design does not allow causal inferences. Additionally, the diversity of IEI subtypes could not be fully explored due to small subgroup sizes. Standardized longitudinal data on total follow-up duration and cumulative IgRT exposure were not available, due to the retrospective and clinically heterogeneous nature of patient records. Instead, current IgRT intervals were used to approximate adherence. Furthermore, as multiple comparisons were conducted without applying a correction method (e.g., Bonferroni adjustment), the potential for type I error should be considered when interpreting the findings.

In conclusion, Type D personality does not appear to be disproportionately elevated in adults with IEI, but its association with psychiatric diagnoses highlights the potential utility of personality-based screening in this population. Incorporating brief, validated tools like the DS14 into clinical care may facilitate early identification of at-risk individuals and support more comprehensive management strategies.

Conflict of Interest

The authors have no conflicts of interest to declare.

Authorship Contributions

Concept: **Reyhan Gumusburun, Sevgi Altay, Aytul Zerrin Sin,** Design: **Reyhan Gumusburun, Omur Ardeniz,** Data collection or processing: **Reyhan Gumusburun, Sevgi Altay, Aylin Okumus, Gülendam Hakverdioglu, Fisun Senuzun Aykar, Berna Cafer Karalar,** Analysis or Interpretation: **Reyhan Gumusburun, Su Ozgur,** Literature search: **Reyhan Gumusburun, Ceyda Tunakan Dalgıc, Ragıp Fatih Kural, Zuleyha Galata, Eda Aslan,** Writing: **Reyhan Gumusburun,** Approval: **Reyhan Gumusburun, Omur Ardeniz, Aytul Zerrrin Sin.**

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