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Procedural anxiety, self-efficacy and fear of malpractice during invasive procedures among emergency medicine residents: a cross-sectional study

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Abstract

Background Emergency medicine residents perform invasive procedures under time pressure, clinical uncertainty, and medico-legal risk, which can generate substantial anxiety among residents themselves. In this study, anxiety refers specifically to the practitioners' own emotional and cognitive responses while performing invasive procedures, rather than to patient-related anxiety. Although fear of malpractice and general anxiety have been studied, their relationship with procedure-specific anxiety and perceived clinical competence has not been examined in an integrated manner among emergency medicine residents.

Methods This two-phase cross-sectional study included 168 emergency medicine residents from emergency departments across Türkiye. An online survey assessed procedure-related anxiety, perceived procedural difficulty, procedural self-efficacy, fear of malpractice, and trait anxiety across nine invasive procedures. Descriptive statistics were calculated, gender differences were examined using independent samples t-tests, and associations among variables were analyzed using Pearson correlation coefficients.

Results Higher perceived procedural difficulty was strongly associated with higher procedure-related anxiety, while higher self-efficacy was strongly associated with lower anxiety. Greater training duration was linked to lower perceived difficulty and anxiety and to higher self-efficacy. Trait anxiety showed moderate positive associations with perceived difficulty and procedure-related anxiety and a negative association with self-efficacy. Fear of malpractice was only weakly associated with procedure-related anxiety and was unrelated to training duration or self-efficacy. Female residents reported higher general and procedure-specific anxiety than male residents. Lack of experience and fear of complications were the most frequently reported sources of anxiety, and supervision by more experienced physicians was the most commonly used and valued coping strategy.

Conclusions Procedure-related anxiety among emergency medicine residents is closely related to perceived difficulty, self-efficacy, and clinical experience, whereas fear of malpractice appears to be a relatively stable

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background concern. These findings suggest that procedural anxiety is a modifiable educational outcome that can be addressed through structured supervision, simulation-based training, and supportive learning environments.

Trial registration Not applicable. This study is an observational cross-sectional survey and was not registered.

Keywords Emergency medicine residents, Procedural anxiety, Self-efficacy, Fear of malpractice, Invasive procedures, Medical education, Residency training

Background

Emergency medicine residency training requires physicians to perform complex invasive procedures and make rapid clinical decisions in life-threatening and highly uncertain situations. In this demanding clinical environment, residents are frequently exposed to procedure-specific psychological challenges that extend beyond general workplace demands. One of the most salient of these challenges is procedural anxiety, defined as the anxiety experienced by physicians themselves during the performance of invasive medical procedures. Procedural anxiety is particularly relevant in emergency medicine, where invasive interventions are often performed under time pressure, with limited information and heightened responsibility for patient outcomes. Existing literature indicates that such high-stakes procedural contexts may intensify anxiety responses, potentially influencing both clinical performance and learning processes [1, 2]. In this context, procedural anxiety represents a core psychological construct for understanding residents' experiences during invasive procedures and forms the primary focus of the present study.

A major psychosocial challenge for emergency medicine residents is fear of malpractice. The World Medical Association defines malpractice as "harm arising from a physician's failure to apply professional knowledge and skills in accordance with accepted medical standards" [3]. The need for rapid clinical decisions in emergency settings heightens medicolegal concerns and contributes to defensive medical behaviors such as ordering unnecessary tests, avoiding certain procedures, or adopting excessively cautious approaches [4, 5]. These practices increase healthcare costs, disrupt patient–physician trust, and are associated with elevated anxiety.

Procedural anxiety represents another critical issue, particularly during invasive interventions that demand advanced technical competence and directly affect patient outcomes. Evidence shows that such anxiety increases the risk of errors, complications, and suboptimal performance [6], while high pre-procedural anxiety may impair clinical decision-making and educational progress [7]. Given the implications for both patient safety and resident training, structured learning environments and effective anxiety-management strategies are essential [8].

From a conceptual perspective grounded in established theoretical accounts of anxiety regulation and perceived competence, procedural anxiety among emergency medicine residents can be understood as a situation-specific emotional response emerging from the interaction between individual predispositions and contextual stressors [9]. According to social cognitive theory, self-efficacy plays a central role in regulating emotional reactions during task performance, with lower perceived competence being associated with higher anxiety under evaluative or high-risk conditions. Within medical training contexts, self-efficacy has consistently been conceptualized as a key psychological determinant of task-related anxiety and performance, particularly in high-demand procedural settings [6]. In procedural training contexts, self-efficacy reflects residents' beliefs in their ability to successfully perform technical tasks under pressure. Higher procedural self-efficacy has been associated with greater confidence, improved attentional control, and more effective emotion regulation, whereas lower self-efficacy may intensify anxiety during invasive procedures. Trait anxiety, as a relatively stable individual disposition, may further amplify emotional reactivity in uncertain and high-risk clinical situations, contributing to variability in residents' experiences of procedural anxiety.

In addition to procedural and contextual factors, biological sex may influence anxiety responses during medical training. Sex-related differences in anxiety have been reported among physicians and postgraduate medical trainees, suggesting that emotional responses to high-pressure clinical situations may not be uniform across male and female residents [10]. Accordingly, examining potential sex-based differences in procedural anxiety, perceived self-efficacy, and fear of malpractice may provide further insight into how emergency medicine residents experience and regulate anxiety during invasive procedures. Collectively, fear of malpractice and procedural anxiety form an interconnected cycle: medicolegal concerns intensify anxiety during procedures, whereas heightened procedural anxiety encourages defensive practices, further reinforcing malpractice fears. Breaking this cycle requires strengthening psychological support within training programs and enhancing residents' ability to regulate anxiety during invasive clinical tasks [11]. To the best of our knowledge, no previous research in Türkiye has simultaneously assessed procedural anxiety, perceived self-efficacy,

perceived procedural difficulty, and malpractice fear within a unified analytical framework among Emergency Medicine residents. By combining quantitative scale-based measures with residents' evaluations of anxiety sources and coping strategies, this study offers a multidimensional perspective on how clinical, psychological, and medicolegal factors interact during invasive procedures.

Based on the existing literature and relevant theoretical frameworks addressing anxiety regulation during complex clinical tasks, the role of self-efficacy in modulating performance-related anxiety, and the influence of medicolegal concerns on physicians' emotional responses, the present study tests the following hypotheses [9, 12].

H1: Higher perceived procedural difficulty is associated with higher levels of procedure-related anxiety among Emergency Medicine residents.

H2: Procedural anxiety is negatively associated with procedural self-efficacy.

H3: Longer residency duration is associated with lower perceived difficulty and anxiety, and higher self-efficacy.

H4: Fear of malpractice is positively associated with procedure-related anxiety.

H5: Trait anxiety is positively associated with both perceived procedural difficulty and procedure-related anxiety, and negatively associated with procedural self-efficacy.

These hypotheses aim to clarify the multidimensional relationships among procedural anxiety, perceived difficulty, self-efficacy, trait anxiety, and malpractice fear within the high-demand emergency medicine environment.

The present study

This study aims to evaluate the relationship between physicians' procedural anxiety and fear of malpractice among emergency medicine residents. Considering the inherently high-stress nature of emergency departments, both professional concerns and medicolegal apprehension are expected to rise. By examining these associations, the study seeks to inform strategies that improve resident well-being, enhance patient safety, and support clinical performance. To differentiate malpractice-related fear and procedure-specific anxiety from general anxiety tendencies, the study also investigates associations with trait anxiety.

Methods

This study was designed as a two-phase cross-sectional investigation aiming to examine emergency medicine

residents' levels of procedural anxiety, perceived self-efficacy, and fear of malpractice, as well as their subjective evaluations regarding the causes of anxiety and preferred coping strategies. Ethical approval was obtained from the Ahi Evran University Clinical Research Ethics Committee prior to data collection (Approval No: 2025-11/122). All procedures adhered to the principles of the Declaration of Helsinki.

Study design and participants

In the first phase of the study, quantitative data were collected to assess the associations among procedural anxiety, perceived difficulty, self-efficacy, fear of malpractice, and trait anxiety. The second phase involved structured questions designed to explore participants' causal attributions regarding procedure-related anxiety and their coping mechanisms. An a priori power analysis was conducted using G*Power 3.1 to determine the minimum required sample size. Assuming an alpha level of 0.05, a statistical power of 0.90, and an expected correlation coefficient of $\rho = 0.25$ under the alternative hypothesis, the minimum sample size was calculated as 168 participants.

Data were obtained anonymously through an online survey administered to emergency medicine residents working in emergency departments across Türkiye. The survey link was disseminated via email, social media channels, and relevant professional groups. The survey was further disseminated through national emergency medicine resident mailing lists, professional social media groups, and peer-to-peer sharing among residents. Because this open distribution strategy did not allow tracking of how many individuals received or viewed the invitation, the total number of residents approached and the response rate could not be determined. Due to the absence of publicly available national statistics on the demographic characteristics of Emergency Medicine residents in Türkiye, direct comparisons between the study sample and the national resident population in terms of age and sex distribution could not be performed. Although the exact size of the national Emergency Medicine resident population could not be verified through publicly available official statistics, the final sample of 168 participants represents a meaningful proportion of residents currently in training in Türkiye. Participants were informed about the study objectives and confidentiality principles, and proceeding to the questionnaire was considered as informed consent. No identifying personal information was collected. The final sample included 168 residents, 42.3% of whom were women, with a mean age of 29.84 years ($SD = 3.55$).

Measurement instruments

Demographic information form

This form collected demographic characteristics including age, gender, and residency duration.

Fear of Malpractice Scale (FMS)

Developed by Katz et al. [13] and adapted into Turkish by Uğrak and Işık [14], this six-item Likert-type scale assesses residents' fear of malpractice. Scores ≤ 15 indicate low, scores between 15 and 20 moderate, and scores ≥ 20 high malpractice fear. The Turkish version demonstrated a Cronbach's alpha of 0.86.

Interventional Procedure Self-Efficacy Scale (IPSS)

Self-efficacy for nine core emergency procedures was evaluated using a 7-point Likert-type item adapted from the single-item self-efficacy approach proposed by Witte [15]. The nine interventional procedures included in this study were selected because they represent core invasive interventions routinely performed during emergency medicine residency training and encompass a range of technical complexity, clinical urgency, and perceived medico-legal risk. Participants rated their agreement with the statement "I can perform this procedure with ease." Higher scores reflect higher perceived procedural self-efficacy. Because the IPSS is a single-item measure, internal consistency statistics cannot be calculated; however, single-item self-efficacy assessments are widely accepted for evaluating specific procedural competencies and demonstrate strong face validity in clinical performance research. Single-item self-efficacy measures are considered appropriate when assessing clearly defined, task-specific competencies, particularly in procedural contexts where clarity and low respondent burden are important. In the present study, procedural self-efficacy was intentionally assessed at the level of individual procedures to capture residents' immediate, experience-based confidence judgments.

The internal consistency of the multi-item scales used in the study was evaluated using Cronbach's alpha coefficients, whereas reliability analysis was not applicable to single-item measures.

Single-item measures were intentionally used for procedural self-efficacy to capture task-specific perceptions of competence in clearly defined clinical procedures. Single-item self-efficacy assessments have been widely employed in procedural and performance-related research, particularly when the construct is concrete, context-specific, and directly observable.

Interventional Procedure Worry Scale (IPWS)

To assess procedure-specific anxiety, a 7-point Likert-type worry scale was developed following the conceptual approach of Peters et al. [16]. Participants rated their

level of worry for each of the nine procedures on a scale from 0 (not worried at all) to 6 (extremely worried), with higher scores indicating greater procedural anxiety.

Because this scale was developed specifically for the present study, a preliminary pilot application was conducted to ensure linguistic clarity and comprehension. The expert review panel consisted of three senior Emergency Medicine specialists, each with over 10 years of clinical experience. Consensus was achieved on linguistic clarity, conceptual consistency, and contextual relevance of all items. In the current sample, the internal consistency of the nine-item worry scale was assessed and found to be acceptable. Although the IPWS was developed specifically for the purposes of this study, all items were explicitly anchored to clearly defined procedural contexts, and internal consistency analysis supported its reliability as a composite measure of procedure-specific anxiety.

Trait Anxiety Scale–Short Form (STAI-T-5)

Trait anxiety was assessed using the five-item short form of the State-Trait Anxiety Inventory (STAI), originally developed by Spielberger et al. and adapted into Turkish by Öner and Le Compte [17]. The short form [18] uses a four-point Likert scale. Scores ≥ 14 indicate high trait anxiety. The Turkish adaptation reported an internal consistency coefficient of 0.83 [19].

Interventional Procedure Difficulty Evaluation Form (IPDEF)

The perceived difficulty of nine core procedures was evaluated using a study-specific, ordinal categorization scheme informed by the framework described by Korenkov, Troidl, and Sauerland [20]. Difficulty levels ranged from I (no difficulty) to IV (substantial difficulty at each stage). This scheme was developed ad hoc for the purposes of the present study and was intended as an operational definition to standardize responses rather than as a formally validated instrument; therefore, no Turkish validation or expert consensus procedure was undertaken.

Coping strategies and perceived sources of anxiety

Structured questions developed by the research team assessed residents' perceived causes of procedural anxiety, their coping strategies, and their views on effective methods for reducing anxiety. Participants could select multiple options where appropriate. These descriptive findings complemented the quantitative results.

Although some of the instruments used in the present study were developed specifically for this research, several methodological steps were undertaken to strengthen measurement validity and transparency. First, newly developed procedure-specific measures were subjected to expert review by senior Emergency Medicine specialists to ensure conceptual clarity, clinical relevance, and

linguistic appropriateness. Second, pilot testing was conducted to verify item comprehensibility and contextual suitability. Third, internal consistency analyses demonstrated satisfactory reliability for all multi-item scales.

The use of single-item measures for procedural self-efficacy was theoretically and methodologically justified, as procedural competence represents a concrete, task-specific construct rather than a latent multidimensional trait. In procedural and performance-related research, single-item self-efficacy assessments have been shown to provide valid and parsimonious indicators of perceived competence when the task is clearly defined.

Statistical analyses

Normality assumptions were evaluated using z-scores based on skewness and kurtosis values, with values between -3.29 and $+3.29$ considered acceptable for normal distribution [21]. Descriptive statistics (means, standard deviations, frequencies, and percentages) were calculated for all variables. Independent samples t-tests were used to assess gender-based differences. Pearson correlation coefficients were computed to examine associations among procedural anxiety, perceived difficulty, self-efficacy, malpractice fear, trait anxiety, and residency duration. All analyses were performed using IBM SPSS Statistics for Windows, Version 29.0 (IBM Corp., Armonk, NY, USA). Given the exploratory and cross-sectional nature of the study, the analyses were intentionally limited to descriptive statistics, group comparisons, and bivariate associations in order to transparently examine relationships among key variables without imposing causal assumptions.

Results

This section reports the demographic characteristics of the participants and summarizes results from measures of procedural anxiety, self-efficacy, perceived procedural difficulty, and fear of malpractice. Descriptive statistics are presented first, followed by analyses of gender differences and associations among study variables. The second part of the study presents participants' evaluations of procedural difficulty, perceived sources of anxiety, and coping strategies, summarized using frequency and percentage distributions.

The internal consistency of the multi-item scales used in the study was evaluated using Cronbach's alpha coefficients. As presented in Table 1, all scales demonstrated good to excellent reliability, with alpha values ranging from 0.836 to 0.903. Specifically, Cronbach's alpha was 0.903 for the Interventional Procedure Worry Scale (IPWS), 0.865 for the Interventional Procedure Difficulty Evaluation Form (IPDEF), 0.836 for the Fear of Malpractice Scale (FMS), 0.896 for the Interventional Procedure Self-Efficacy Scale (IPSS) and 0.868 for the Trait Anxiety

Table 1 Internal consistency reliability of multi-item scales

Scale	Abbreviation	Item Number (n)	Cronbach's α
Interventional Procedure Worry Scale	IPWS	9	0.903
Interventional Procedure Difficulty Evaluation Form	IPDEF	9	0.865
Fear of Malpractice Scale	FMS	6	0.836
Trait Anxiety Scale – Short Form	STAI-T-5	5	0.868

Cronbach's alpha values ≥ 0.70 were considered acceptable, ≥ 0.80 good, and ≥ 0.90 excellent reliability

Scale–Short Form (STAI-T-5). Internal consistency was assessed only for multi-item scales, as single-item measures, such as procedural self-efficacy, do not allow the estimation of reliability coefficients.

The mean age of the sample was 29.84 ± 3.55 years, and the average duration of EM residency training was 25.42 ± 14.99 months. Descriptive statistics showing the means scores, standard deviations, and minimum and maximum scores are given in Table 2. The wide range observed in the minimum and maximum values of the variables indicates substantial variability, suggesting a heterogeneous structure in terms of participants' individual characteristics and levels of experience.

Gender-based comparisons indicated that female participants had higher levels of procedural anxiety and trait anxiety compared with their male counterparts. No significant gender differences were observed for any of the other variables (Table 3).

To examine the relationships among the variables, Pearson correlation coefficients were calculated. Correlation analyses showed that as the duration of residency increased, scores for perceived procedural difficulty and procedural anxiety decreased, whereas self-efficacy scores increased. Perceived procedural difficulty was positively correlated with procedural anxiety and negatively correlated with self-efficacy. Procedural anxiety demonstrated a positive association with trait anxiety and a negative association with self-efficacy. Trait anxiety was

Table 2 Descriptive Statistics for variables ($N=168$)

Variable	Mean	Std. Dev.	Min.	Max.
Age	29.84	3.550	24	50
Duration of residency	25.42	14.99	1	60
IPDEF	19.17	4.99	9	36
IPWS	18.56	10.83	0	54
IPSS	44.73	10.76	12	63
FMS	24.61	4.14	14	30
STAI-T-5	10.39	3.15	5	19

IPDEF Interventional Procedure Difficulty Evaluation Form, IPWS Interventional Procedure Worry Scale, IPSS Interventional Procedure Self-Efficacy Scale, FMS Fear of Malpractice Scale, STAI-T-5: State-Trait Anxiety Inventory – Trait form (short 5-item version)

Table 3 Independent samples t-test

		Mean (SD)	t	p	Cohen's d
IPDEF	Women	19.39 (4.91)	0.491	0.624	0.077
	Men	19.01 (5.07)			
IPWS	Women	21.13 (10.55)	2.677	0.008	0.418
	Men	16.68 (10.70)			
IPSS	Women	43.62 (10.82)	-1.147	0.253	-0.179
	Men	45.55 (10.70)			
FMS	Women	24.70 (4.20)	0.259	0.796	0.041
	Men	24.54 (4.12)			
STAI-T-5	Women	11.44 (2.96)	3.822	<0.001	0.597
	Men	9.63 (3.08)			

IPDEF Interventional Procedure Difficulty Evaluation Form, IPWS Interventional Procedure Worry Scale, IPSS Interventional Procedure Self-Efficacy Scale, FMS Fear of Malpractice Scale, STAI-T-5 State-Trait Anxiety Inventory-Trait Anxiety Short Form, SD standard deviation. The degree of freedom for the t-test was 166. Significant values are written in bold

positively correlated with both perceived procedural difficulty and procedural anxiety, and negatively correlated with self-efficacy. Fear of malpractice showed only weak positive correlations with procedural anxiety and trait anxiety. These results demonstrate that the significant relationships among the variables align with the values presented in the table (Table 4).

Table 5 presents the perceived difficulty levels of nine fundamental interventional procedures among Emergency Medicine residents. The findings indicate that the highest mean difficulty scores were reported for Chest Tube Insertion (CTI), Internal Jugular Central Venous Catheterization (IJVCV), and Fracture Reduction (FR). In contrast, the lowest mean difficulty scores were observed for Electrical Cardioversion (ECV), Paracentesis, and Femoral Central Venous Catheterization (FCVC). Endotracheal Intubation (ETI) and Thoracentesis (THOR) were rated as procedures of moderate difficulty.

As shown in Table 6, lack of experience was the most frequently reported source of procedural anxiety (88.7%), clearly outweighing all other contributing factors. High proportions of residents also identified fear of complications (67.9%) and patient-related challenges, such as non-cooperation, obesity, or communication difficulties (61.3%), highlighting the combined influence of technical

Table 5 Perceived difficulty of interventional procedures among Emergency Medicine residents (N= 168)

Procedure	Mean	Std. Dev.
Difficulty_ETI	1.92	0.73
Difficulty_FCVC	1.82	0.72
Difficulty_IJVCV	2.52	0.80
Difficulty_THOR	2.36	0.92
Difficulty_Paracentesis	1.69	0.73
Difficulty_FR	2.47	0.85
Difficulty_DF	2.25	0.85
Difficulty_CTI	2.58	0.87
Difficulty_ECV	1.56	0.72

ETI Endotracheal Intubation, FCVC Femoral Central Venous Catheterization, IJVCV Internal Jugular Central Venous Catheterization, THOR Thoracentesis, Paracentesis Paracentesis, FR Fracture Reduction, DF Defibrillation, CTI Chest Tube Insertion, ECV Electrical Cardioversion

Table 6 Perceived causes of anxiety regarding interventional procedures

Item	Frequency (%)
Lack of experience	149 (88.7)
Fear of complications	114 (67.9)
Patient-related factors (e.g., non-compliance, obesity, communication difficulties)	103 (61.3)
Legal consequences of malpractice regulations	99 (58.9)
Fear of failure	89 (53.0)
Urgency of the procedure	85 (50.6)
Time constraints	60 (35.7)

uncertainty and patient complexity on procedural stress. More than half of the participants (58.9%) indicated that concerns related to malpractice regulations contributed to their anxiety, reflecting the perceived impact of the medicolegal environment on clinical practice. In contrast, situational demands such as procedural urgency (50.6%) and time constraints (35.7%) were reported less often, suggesting that while the time-pressured nature of emergency care may be normalized through training, uncertainty and perceived clinical and legal risk remain the predominant sources of anxiety.

An analysis of the coping strategies used by Emergency Medicine residents to manage procedure-related anxiety showed that the most frequently employed approach

Table 4 Pearson correlation coefficients between variables

Variable	Mean (SD)	1	2	3	4	5	6
1. Age	29.84 (3.55)	-					
2. Duration of residency	25.42 (14.99)	0.22**	-				
3. IPDEF	19.17 (4.99)	-0.06	-0.19*	-			
4. IPWS	18.56 (10.83)	-0.26***	-0.36***	0.68***	-		
5. IPSS	44.73 (10.76)	0.15	0.31***	-0.56***	-0.72***	-	
6. FMS	24.61 (4.14)	-0.02	-0.12	0.10	0.17*	-0.04	-
7. STAI-T-5	10.39 (3.15)	-0.05	-0.08	0.34***	0.40***	-0.29***	0.30***

IPDEF Interventional Procedure Difficulty Evaluation Form, IPWS Interventional Procedure Worry Scale, IPSS Interventional Procedure Self-Efficacy Scale, FMS Fear of Malpractice Scale, STAI-T-5 State-Trait Anxiety Inventory-Trait Anxiety Short Form. * $p < .05$, ** $p < .01$, *** $p < .001$. Significant values are written in bold

was performing the procedure under the supervision of a more experienced physician (78.0%). This was followed by structured preparatory behaviors, such as reviewing the protocol, checking the equipment, and completing pre-procedure preparation (50.0%). Additionally, 46.4% of participants reported reducing anxiety by diverting attention away from their worry and focusing more intently on the procedure itself. Self-reinforcement strategies aimed at boosting confidence (35.1%) and physical relaxation techniques such as breathing exercises (7.7%) were reported at lower frequencies. One participant described their coping approach as, “I don’t think—I just do it.” (Table 7).

Emergency Medicine residents’ evaluations of the methods they believe to be effective in reducing procedural anxiety are presented in Table 8. Most participants indicated that performing the procedure under the supervision of a more experienced physician would be effective in alleviating anxiety (80.4%). This was followed by improvements in working conditions—such as increased time, reduced patient load, and fewer night shifts (78.0%). Additionally, 61.9% of participants reported that regulatory adjustments aimed at reducing the severity of malpractice penalties could help lower anxiety levels, while 60.7% stated that increasing the frequency of simulation-based training would have a similar effect. At lower rates, participants noted that psychoeducation and psychosocial support programs could contribute to anxiety management (24.4%). A smaller number of residents also suggested that increasing awareness regarding Emergency Medicine physicians’ competence in performing interventional procedures, or performing such procedures more frequently, may further help reduce anxiety.

Discussion

This study examined, in a multidimensional framework, the relationships among procedural anxiety, perceived self-efficacy, fear of malpractice, and trait anxiety among Emergency Medicine residents in Türkiye. The findings indicate that procedural anxiety is not solely associated with individual psychological characteristics, but is also closely related to structural components of the emergency department environment, including time pressure, high patient turnover, and diagnostic uncertainty [22]. The fact that residents must frequently perform invasive procedures within limited time frames and under a heightened perception of risk may contribute to increased concerns about making mistakes and the accompanying medicolegal apprehension. This pattern suggests that perceived self-efficacy may be shaped not only by technical skill but also by residents’ perceptions of medicolegal risk [13, 14].

Table 7 Strategies used to cope with interventional procedure-related anxiety

Item	Frequency (%)
Performing the procedure under the supervision of a more experienced practitioner (e.g., senior resident, specialist, consultant)	131 (78.0)
Conducting pre-procedure preparation such as equipment checks and reviewing the protocol	84 (50.0)
Redirecting attention away from anxiety and focusing on the procedure	78 (46.4)
Engaging in self-affirmation, encouraging oneself by recalling previous successful procedures	59 (35.1)
Using physical relaxation techniques (e.g., breathing exercises, progressive muscle relaxation)	13 (7.7)
Other: "I don't think about it, I just do."	1 (0.6)

Table 8 Effective ways to reduce anxiety related to interventional procedures

Item	Frequency (%)
Having a more experienced practitioner accompany the procedure	135 (80.4)
Improvements in working conditions (e.g., more time, fewer patients, fewer overnight shifts)	131 (78.0)
Mitigation of malpractice penalties	104 (61.9)
Frequent simulation-based training	102 (60.7)
Implementation of psychoeducation and psychosocial support programs to improve anxiety management skills	41 (24.4)
Other: Convincing all relevant parties that interventional procedures can be performed by Emergency Medicine physicians	1 (0.6)
Other: Performing cases and procedures more frequently	1 (0.6)

The present study implicitly treats procedural anxiety as a uniformly detrimental phenomenon; however, established performance psychology frameworks describe a non-linear relationship between anxiety and performance, often characterized by an inverted U-shaped pattern [9]. An inverted U-shaped association has frequently been described, in which moderate levels of anxiety or arousal are associated with optimal performance, whereas both very low and very high anxiety levels are linked to poorer outcomes. From this perspective, a certain degree of procedural anxiety may reflect appropriate vigilance, situational awareness, and concern for patient safety, particularly during high-risk invasive interventions. In contrast, excessive anxiety may impair fine motor control, cognitive flexibility, decision-making speed, and procedural flow, thereby increasing the risk of errors or inefficiency.

The findings related to gender differences, consistent with previous research [10], showed that female residents exhibited higher levels of both trait anxiety and

procedure-specific anxiety, while no significant differences were observed in perceived difficulty, self-efficacy, or fear of malpractice. This pattern suggests that gender-related vulnerability may be more prominent in emotional responses rather than in technical competence or medicolegal concerns. In high-stress environments such as emergency departments—where rapid decision-making is essential—these emotional differences may contribute to the subjective pressure experienced during interventional procedures, whereas professional training and medicolegal expectations appear to be perceived similarly regardless of gender [13, 22].

The correlation analyses demonstrated that as the duration of residency increased, perceived procedural difficulty and procedure-specific anxiety tended to decrease, whereas self-efficacy increased. The strong positive associations of perceived difficulty with both procedure-specific anxiety and trait anxiety, along with its negative association with self-efficacy, and the inverse relationships between self-efficacy and both general and procedure-specific anxiety, are consistent with established models of skill acquisition and self-efficacy [23]. In Emergency Medicine practice, interventional skills are learned on real patients, often under time pressure and variable supervision. As experience accumulates, the ability to manage uncertainty may improve, and procedural decision-making may become more automatic. This developmental process could contribute to reduced psychological anxiety and enhanced clinical self-confidence [16, 22, 24]. Accordingly, lower procedural anxiety should not necessarily be interpreted as universally desirable; rather, the goal of training interventions may be to prevent excessive anxiety while preserving adaptive levels of alertness and responsibility. This interpretation is particularly relevant in emergency medicine settings, where complete emotional disengagement may be as problematic as overwhelming anxiety.

Although residents with higher levels of trait anxiety tended to perceive procedures as more difficult and to experience greater procedural anxiety, the findings indicate that trait anxiety alone may not fully account for procedure-specific anxiety [25]. This suggests that procedural anxiety is likely influenced by a combination of individual temperament and domain-specific factors such as technical demands, training exposure, quality of supervision, and the inherent uncertainty of clinical situations. The observation that procedure-related anxiety in emergency department settings appears to be more sensitive to situational stressors and experience level than to stable personality traits highlights the importance of structured training and repeated practice in reducing anxiety [13, 18].

Fear of malpractice was only weakly linked to both procedure-specific anxiety and trait anxiety, and it

showed no significant association with either experience or self-efficacy. Taken together, this suggests that medicolegal worry is unlikely to be a direct, proximal driver of residents' procedural distress. In this context, these findings suggest that medicolegal worry functions less as a direct explanatory variable for procedural distress and more as a structural, experience-independent factor that shapes the contextual background of anxiety. Rather, it may reflect a more stable, low-level background concern that persists across training years. In other words, its relevance may lie less in intensifying moment-to-moment procedural anxiety and more in shaping downstream outcomes. Indeed, malpractice-related concern has been described as one of several contextual factors associated with defensive medical tendencies [13], and it may indirectly contribute to burnout and influence physician–patient interactions [14, 22, 26]. This interpretation is plausible in high-risk emergency settings, where adverse outcomes can occur even when care is appropriate. As a result, the possibility of legal scrutiny may remain salient regardless of technical competence. Notably, many residents also endorsed malpractice-related concerns on the perception items, suggesting that this issue may matter more because it is common than because it strongly predicts procedural anxiety. Overall, our results indicate that malpractice-related apprehension is present but only modestly related to procedural anxiety, and it should be considered one contextual influence among multiple determinants rather than a primary explanatory factor. Future work should examine whether medicolegal worry is more strongly associated with outcomes such as defensive clinical decisions, documentation practices, burnout, or physician–patient communication than with procedural anxiety itself.

From a patient safety perspective, elevated procedural anxiety and fear of malpractice among Emergency Medicine residents may influence clinical risk perception and decision-making processes. Adjustments in cognitive appraisal under heightened anxiety may lead to more cautious or risk-averse approaches, particularly within high-pressure emergency settings, which could have implications for clinical workflow and care quality.

Trait anxiety showed a moderate association with both procedure-specific anxiety and perceived difficulty, and an inverse relationship with self-efficacy. The evaluations obtained in the second part of the study—regarding residents' perceptions of procedural difficulty, sources of anxiety, and coping strategies—were consistent with these quantitative findings. The application of interventional procedures across heterogeneous patient profiles, under variable clinical conditions, and often with limited preparation time makes it challenging to standardize residents' perceptions; this suggests that the measured levels of anxiety and perceived difficulty likely reflect a

combination of individual and contextual factors. From this perspective, the qualitative data play an important explanatory role by illustrating the clinical counterparts of the relationships identified in the quantitative analyses.

Residents most frequently identified lack of experience as the primary source of procedural anxiety, followed by fear of complications and patient-related factors. Concerns about potential legal consequences arising from malpractice regulations and fear of failure were also common, whereas time pressure and urgency were reported less frequently. This distribution aligns with the correlational findings that underscore the multifactorial nature of physician anxiety [27, 28]. The relatively lower emphasis on time pressure within the emergency department context may suggest that this element has become a routine component of clinical practice, whereas anxiety may cluster around factors perceived as less controllable and associated with more severe consequences [16, 24].

The coping strategies reported by residents were predominantly structural in nature, with the most frequently preferred approach being performing procedures under the supervision of a more experienced physician. This was followed by pre-procedure preparation and deliberate task-focused attention, while psychological coping strategies appeared to be used less frequently. Similarly, the factors perceived as most effective in reducing anxiety included enhanced supervision and improved working conditions. These findings suggest that, within the culture of Emergency Medicine, anxiety may be mitigated more effectively through systemic adjustments than through individual coping strategies [14, 22]. The limited use of psychological interventions may reflect restricted awareness or uncertainty regarding their applicability. Accordingly, integrating brief, evidence-based stress-management components into simulation and procedural training programs may represent a feasible approach with potential psychological and clinical benefits [16, 18].

Taken together, these findings indicate that procedural anxiety among emergency medicine residents is not merely an individual psychological phenomenon but a modifiable educational outcome shaped by training exposure, supervision, and medico-legal context. Therefore, residency curricula should explicitly address procedural anxiety alongside technical competence by integrating structured simulation, graded clinical responsibility, and supervised first-attempt experiences for high-risk procedures. In particular, residents with high IPWS and low IPSS scores may be identified as priority learners who would benefit from targeted, simulation-based mastery learning and enhanced faculty supervision during early procedural encounters.

From an educational planning perspective, these results also support a tiered intervention framework. In

the short term, residency programs can implement procedure-specific simulation thresholds and mandatory supervised practice for residents with elevated procedural anxiety. At the program level, structured feedback, mentoring, and medico-legal education may help normalize error management and reduce fear-driven avoidance behaviors. At the institutional and policy level, improving staffing, supervision ratios, and medico-legal support systems may further mitigate anxiety that persists despite growing experience. Importantly, the IPWS, IPSS, and FMS used in this study provide measurable outcomes that can be applied longitudinally to evaluate the effectiveness of such interventions within residency training programs.

Limitations

An important conceptual limitation of the present study is the absence of objective or proxy measures of procedural performance. As a result, the findings cannot determine whether higher procedural anxiety merely reflects an unpleasant subjective experience or whether it meaningfully impairs procedural success, efficiency, or complication rates. Although performance anxiety has been extensively studied in domains such as sports and cognitive tasks—where anxiety under pressure is known to impair execution—similar mechanisms in clinical medicine remain insufficiently examined. In invasive emergency procedures, where fine motor control, rapid decision-making, and situational awareness are critical, such mechanisms are highly plausible.

This study has several limitations that should be acknowledged. An additional limitation of this study relates to the assessment of sample representativeness. Although participants were recruited from multiple institutions and training levels, the lack of publicly available national data on the demographic composition of Emergency Medicine residents in Türkiye precluded formal comparisons regarding age and sex distribution. Accordingly, the representativeness of the sample should be interpreted with caution, and future studies would benefit from access to centralized national residency statistics. First, because the survey was distributed through open online channels and professional professional networks, it was not possible to determine how many residents were reached or declined participation, and therefore a formal response rate could not be calculated. This recruitment strategy may have introduced self-selection bias, as residents experiencing higher levels of procedural anxiety or medico-legal concerns may have been more inclined to participate. However, while this may affect prevalence estimates, the observed associations between procedural anxiety, self-efficacy, fear of malpractice, and trait anxiety are less likely to be substantially distorted by this type of selection bias, which primarily influences

who participates rather than how variables relate to one another.

Beyond self-selection related to survey participation, potential selection effects at the specialty level should also be considered. Individuals with very high baseline anxiety may be less likely to choose, enter, or remain in medical specialties characterized by frequent exposure to acute stress, invasive procedures, and high clinical responsibility, such as emergency medicine. Over time, this process may result in a form of natural selection, whereby residents who remain in emergency medicine represent a psychologically more resilient subgroup. Such selection effects may restrict the observable range of anxiety levels in the sample and potentially lead to an underestimation of the true impact of anxiety on learning, performance, or well-being. Second, the cross-sectional design does not allow causal inferences to be drawn regarding the relationships among procedural anxiety, perceived difficulty, self-efficacy, trait anxiety, and fear of malpractice. Third, all variables were measured through self-report questionnaires completed online, which may be subject to recall bias and social desirability effects. Fourth, although the sample included Emergency Medicine residents from various hospitals across Türkiye, the findings may not fully represent residents working in different institutional, cultural, or medicolegal environments. Additionally, some of the measurement tools used in the study, particularly the Interventional Procedure Worry Scale (IPWS) and Interventional Procedure Difficulty Evaluation Form (IPDEF), do not have formal Turkish validation studies; however, pilot testing and expert review were conducted to strengthen content validity. Finally, the study did not incorporate objective performance indicators or simulation-based assessments, which limits the ability to interpret procedural anxiety in relation to actual clinical performance. Accordingly, the results should be interpreted as reflecting psychological and perceptual dimensions of procedural experience rather than direct measures of procedural competence or safety outcomes. Future studies incorporating objective performance indicators may further clarify whether the relationship between procedural anxiety and clinical performance follows a linear or non-linear pattern in emergency medicine training. Some of the measurement instruments used in this study, including the Interventional Procedure Worry Scale and the Interventional Procedure Difficulty Evaluation Form, were developed specifically for the purposes of this research and therefore lack formal external validation. Although pilot testing, expert review, and internal consistency analyses were conducted to strengthen content validity, the absence of prior validation studies may limit the generalizability and replicability of these measures. Future research should

aim to validate these instruments across different clinical settings and populations.

Although more advanced multivariable or structural modeling approaches could further elucidate complex relationships among procedural anxiety, self-efficacy, trait anxiety, and contextual factors, such analyses were beyond the scope of the present exploratory and cross-sectional design. The current analytic strategy was intentionally selected to describe and examine bivariate associations without imposing causal assumptions. Future longitudinal studies employing multivariable, mediation, or multilevel models may provide a more comprehensive understanding of these relationships over time.

Conclusion

This study indicates that procedural anxiety among Emergency Medicine residents is shaped primarily by clinical experience, perceived procedural difficulty, and self-efficacy, whereas trait anxiety and fear of malpractice appear to play comparatively smaller roles. These findings suggest that anxiety during invasive procedures is not a fixed personal characteristic, but rather a dynamic and modifiable phenomenon that can be meaningfully influenced through educational and institutional interventions. However, further longitudinal and performance-based studies are required to determine how these psychological factors translate into measurable procedural outcomes. In particular, residents' emphasis on insufficient experience and fear of complications underscores the importance of stronger supervision, structured procedural training, and expanded use of simulation in residency programs. Improvements in working conditions and in the clinical learning environment may further help reduce anxiety-driven defensive behaviors and promote safer, more confident clinical decision-making.

Importantly, the measurement framework used in this study provides a practical tool for educational planning and program evaluation. The Interventional Procedure Worry Scale (IPWS), Interventional Procedure Self-Efficacy Scale (IPSS), and Fear of Malpractice Scale (FMS) can be applied longitudinally within residency programs to identify residents at risk of excessive procedural anxiety, to guide targeted simulation and supervision strategies, and to objectively assess the impact of curriculum-level interventions over time.

From a broader systems perspective, aligning residency curricula with competency-based training models, strengthening institutional support mechanisms, and reconsidering the impact of existing medicolegal frameworks may jointly contribute to improving both resident well-being and patient safety. Future longitudinal and multicenter studies incorporating objective performance indicators are needed to clarify how procedural anxiety

evolves with clinical competence over time and to determine how targeted educational and policy interventions can best support Emergency Medicine residents in high-risk procedural settings.

Abbreviations

SD	Standard deviation
FMS	Fear of Malpractice Scale
IPSS	Interventional Procedure Self-Efficacy Scale
IPWS	Interventional Procedure Worry Scale
STAI	State–Trait Anxiety Inventory
STAI-T-5	State–Trait Anxiety Inventory – Trait form (short 5-item version)
IPDEF	Interventional Procedure Difficulty Evaluation Form
SPSS	Statistical Package for the Social Sciences
ETI	Endotracheal Intubation
FCVC	Femoral Central Venous Catheterization
IJVCV	Internal Jugular Central Venous Catheterization
THOR	Thoracentesis
Paracentesis	Paracentesis
FR	Fracture Reduction
DF	Defibrillation
CTI	Chest Tube Insertion
ECV	Electrical Cardioversion

Supplementary Information

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Supplementary Material 1.

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Authors' contributions

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Data availability

The datasets generated and analyzed during the current study are not publicly available due to institutional data protection policies and ethical restrictions, but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The study protocol was reviewed and approved by the Ethics Committee of Ahi Evran University Faculty of Medicine (Decision No: 2025-11/122). All procedures were conducted in accordance with the ethical standards of the Declaration of Helsinki. All participants were informed about the purpose, scope, and confidentiality principles of the study before accessing the online questionnaire. Participation was entirely voluntary, and no identifying personal data were collected at any stage of the research. Proceeding to the survey was considered as the provision of informed consent. In accordance with the ethical approval granted by the Ethics Committee, written informed consent was not required due to the anonymous and non-interventional nature of the study.

Consent for publication

Not applicable. This manuscript does not contain any individual person's data in any form (including individual details, images, or videos). All data were collected and analyzed anonymously.

Competing interests

The authors declare no competing interests.

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