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Peer Review of *World Journal of Gastroenterology*, Payton Yau, PhD, Lecturer, Department of Biosciences, School of Science and Technology, Nottingham Trent University, Nottingham NG11 8NS, United Kingdom. payton.yau@ntu.ac.uk

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World Journal of Gastroenterology is an international, peer-reviewed, open-access journal dedicated to advancing cutting-edge research and clinical practice across the full spectrum of gastroenterology and hepatology. The journal welcomes studies addressing diseases of the esophagus, stomach, small intestine, colon and rectum, pancreas, gallbladder, bile ducts, and liver. The journal publishes a diverse range of article types, including: Original clinical and basic research, translational studies, reviews and mini-reviews, editorials and correspondences, and case reports. We invite researchers, clinicians, and multidisciplinary experts worldwide to submit high-quality manuscripts and contribute to shaping the future of gastrointestinal science.

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ORIGINAL ARTICLE

Observational Study

Burnout and endoscopy-specific workload among gastroenterologists and gastroenterology fellows in Türkiye: A national cross-sectional survey

Yavuz Özden, Rasim Eren Cankurtaran, Çağlayan Keklikkıran, Çağdaş Erdoğan

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Abstract

BACKGROUND

Gastroenterologists in high-volume, public-sector-dominant healthcare systems face occupational strain from endoscopic workload, out-of-hours duties, and administrative demands. Evidence linking validated burnout measures to endoscopy-specific workload indicators remains limited.

AIM

To determine burnout levels and workload-related and organisational correlates of high personal burnout among responding gastroenterologists and fellows in Türkiye.

METHODS

A national cross-sectional anonymous online survey was conducted in May 2026 using the Copenhagen Burnout Inventory (CBI) and a purpose-designed endoscopy workload module. Recruitment *via* professional networks and snowball sampling precluded calculation of a formal response rate. Of 352 submitted

records, 278 eligible physicians were included. CBI scores were transformed to a 0-100 scale; a score of 50 or higher indicated high burnout. Multivariable logistic regression, Spearman correlations, and sensitivity analyses using continuous personal burnout scores were performed.

RESULTS

CBI scores of 50 or higher were observed in 79.5%, 78.1%, and 69.8% of respondents for personal, work-related, and patient-related burnout, respectively; median scores were 71, 70, and 64. These values describe a self-selected respondent sample, not national prevalence. Monthly on-call frequency showed a graded association with personal burnout (*P* for trend < 0.001). High personal burnout was independently associated with six or more monthly on-call shifts [adjusted odds ratio (OR) = 4.82], out-of-hours endoscopy duty (adjusted OR = 3.45), more than 60 procedures/week (adjusted OR = 2.91), inadequate staff support (adjusted OR = 2.68), and six or more outpatient sessions/week (adjusted OR = 2.40). Only 6/278 respondents (2.2%) reported institutional psychological support.

CONCLUSION

Responding gastroenterologists and fellows reported high burnout scores associated with modifiable workload and organisational factors, supporting system-level interventions; findings should not be interpreted as causal effects or national prevalence estimates.

Key Words: Burnout; Copenhagen Burnout Inventory; Endoscopy workload; Gastroenterology; Occupational stress; Türkiye

Core Tip: This national cross-sectional survey of 278 gastroenterologists and gastroenterology fellows in Türkiye found that responding physicians reported high burnout scores across all Copenhagen Burnout Inventory domains. A personal burnout score of 50 or higher was independently associated with six or more monthly on-call shifts [adjusted odds ratio (OR) = 4.82], out-of-hours endoscopy duty (adjusted OR = 3.45), more than 60 endoscopic procedures per week (adjusted OR = 2.91), inadequate endoscopy unit staff support (adjusted OR = 2.68), and six or more outpatient sessions per week (adjusted OR = 2.40). Only 6/278 respondents (2.2%) reported access to institutional psychological support. Because the sample was self-selected, these findings should be interpreted as respondent-level associations rather than national prevalence estimates. The results highlight modifiable workload and organisational correlates of burnout and support system-level interventions.

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INTRODUCTION

Physician burnout is a well-documented occupational health problem that compromises job satisfaction, patient safety, quality of care, and retention in clinical practice[1,2]. Although long working hours are a recognised contributor, burnout arises from the cumulative interplay of workload intensity, time pressure, administrative demands, emotional strain, insufficient recovery, and limited organisational support[3,4]. These conditions are especially pronounced in procedural specialties, where complex clinical decision-making coincides with high patient throughput, sustained technical demands, and unpredictable emergency responsibilities.

Gastroenterology practice has several features that heighten exposure to occupational strain. Compared with general outpatient work, endoscopic practice imposes distinct cognitive, technical, and physical demands that are not adequately captured by total working hours alone. Endoscopic procedures require sustained concentration, fine motor precision, physical effort, and the immediate management of unexpected findings or procedure-related complications[5,6]. During a single procedure, the endoscopist may need to recognise and characterise lesions, assess malignant potential or procedural risk, decide whether endoscopic therapy is appropriate, and determine whether escalation to surgical or multidisciplinary management is required[7]. In high-volume units, endoscopy lists are frequently conducted under strict time constraints, with tightly packed schedules, minimal recovery intervals, and frequent list overruns that prolong the working day[8]. Out-of-hours emergency endoscopy for acute upper gastrointestinal bleeding, acute cholangitis, food bolus obstruction, or foreign body ingestion disrupts sleep, limits recovery, and interferes with family life[9]. These procedure-specific demands may be linked to burnout through cognitive load, technical performance pressure, physical fatigue, and reduced recovery time-mechanisms that differ from those associated with outpatient volume alone.

Despite these concerns, the contribution of endoscopy-specific workload factors to burnout among gastroenterologists remains inadequately characterised. The broader literature on physician burnout has identified generic contributors such as excessive workload, work-life imbalance, administrative burden, and insufficient organisational support. However, this literature does not fully address the narrower and clinically important question of how procedure-specific exposures shape burnout risk in gastroenterology. Most previous studies have focused on general occupational determinants, whereas fewer have examined procedural volume, emergency or unscheduled endoscopy, list overruns, after-hours communication, documentation burden, and the adequacy of endoscopy unit staffing as distinct, potentially modifiable

contributors[10-12]. Moreover, the available evidence is drawn predominantly from North America and Western Europe, which limits its applicability to healthcare systems with different workforce structures, public sector responsibilities, service pressures, and institutional support mechanisms[13,14].

Türkiye provides a relevant and understudied context in which to examine these questions. Gastroenterology services are delivered largely within a public hospital framework, where specialists and fellows routinely manage high outpatient volumes, substantial endoscopic workloads, and emergency procedural responsibilities, often with variable personnel and administrative support. This setting is particularly suitable for evaluating whether burnout among gastroenterology physicians is associated not only with overall clinical workload, but also with endoscopy service organisation, including on-call exposure, out-of-hours endoscopy, list overruns, and endoscopy unit staffing. National data on burnout among gastroenterologists and gastroenterology fellows in Türkiye remain scarce, and the associations between validated burnout domains and endoscopy-specific workload have not been systematically evaluated.

In this national cross-sectional survey, we combined the Copenhagen Burnout Inventory (CBI) with a purpose-designed endoscopy workload module. The CBI captured personal, work-related, and patient-related burnout, while the module assessed procedural volume, emergency or unscheduled endoscopy, out-of-hours duties, list overruns, after-hours communication, documentation burden, staff support, institutional psychological support, and career-related consequences. By linking a validated multidimensional burnout instrument with specialty-specific workload indicators, this study aimed to examine associations between modifiable organisational and procedural workload factors and burnout among gastroenterologists and gastroenterology fellows in Türkiye. We specifically sought to distinguish general occupational strain from endoscopy-related workload exposures and to identify service-level targets that may inform interventions to protect physician well-being and sustain endoscopic service delivery.

MATERIALS AND METHODS

Study design and setting

This national, cross-sectional, anonymous online survey was conducted among gastroenterology specialists and gastroenterology fellows practising in Türkiye between 1 and 31 May 2026. The study was designed to evaluate burnout and endoscopy-specific workload indicators in routine gastroenterology practice. The primary purpose was to describe burnout levels among responding physicians and to examine associations between burnout domains and endoscopy-specific workload exposures; the study was not designed to generate probability-based national prevalence estimates. The protocol received approval from the Kayseri City Hospital Non-Interventional Clinical Research Ethics Committee (approval No. 2026/900; approval date: 28 April 2026). Electronic informed consent was obtained from all participants before they could access the questionnaire. The study was conducted in accordance with the Declaration of Helsinki and reported according to the STROBE and CHERRIES recommendations[15,16].

Participants and recruitment

Eligible participants were physicians actively practising gastroenterology in Türkiye, encompassing both gastroenterology specialists and fellows. Specialists included academic faculty, those completing obligatory service, defined as the mandatory public service required of medical specialists in Türkiye, and those who had fulfilled this obligation. Physicians who did not consent, were retired, were clinically inactive, or had missing information on professional status were excluded.

Recruitment was conducted through professional mailing lists, institutional contacts, and national gastroenterology networks. Initial invitations were sent to 835 physicians. The invitation strategy used overlapping professional channels, including available mailing lists, institutional contacts at gastroenterology units, and national gastroenterology networks. Because these channels overlapped and the survey link could be forwarded to eligible colleagues, snowball sampling was permitted. For this reason, channel-specific unduplicated denominators and the final number of eligible recipients could not be reconstructed, and a formal response rate could not be calculated. The survey remained open for four weeks, and a single reminder was circulated during this period. To preserve anonymity, no personal identifiers were collected. IP address tracking, cookies, and email verification were not used. Submitted records were reviewed before analysis for consent status, eligibility, professional status, completeness, and exact duplicate response patterns; no duplicate eligible record was retained in the final analytic dataset. Of the 352 survey records submitted, 278 consenting, non-retired physicians who met all eligibility criteria were retained for the final analysis.

Survey instrument

A 42-item questionnaire was constructed, covering demographic and professional characteristics, career-related outcomes, the CBI, and an endoscopy workload module. The study-specific questionnaire components, including all endoscopy workload module items, response options, and analytic coding, are provided as Supplementary material. The CBI items are not reproduced in the supplement; the validated Turkish version was used and scored according to the original scoring instructions.

CBI: Burnout was assessed using the CBI, a validated multidimensional instrument that measures personal, work-related, and patient-related burnout[17]. The CBI was administered in Turkish and scored according to the original CBI scoring instructions; previous research in Türkiye has used the CBI in physician samples[17,18]. The 19-item CBI yields three domain scores: Personal burnout, reflecting general exhaustion; work-related burnout, reflecting exhaustion attributed to work; and patient-related burnout, reflecting exhaustion linked to patient care. Each item is rated on a five-point scale

and scores are transformed to a 0-100 scale, with higher values denoting greater burnout. Domain scores were analysed both as continuous variables and as binary outcomes. For comparability with previous CBI-based studies, a domain score of 50 or higher was used as a prespecified threshold for clinically relevant burnout[19]. Because this cut-off has not been specifically validated among Turkish gastroenterologists, threshold-based findings were interpreted cautiously and continuous CBI score analyses were also emphasised. Cronbach's alpha was computed for each subscale to confirm internal consistency in the study sample.

Endoscopy workload module: To capture gastroenterology-specific workload exposures not covered by existing instruments, a 12-item endoscopy workload module was developed for this study. Items were generated through a review of relevant literature and structured discussions among gastroenterologists experienced in high-volume endoscopy practice. The draft module was reviewed qualitatively for relevance, coverage, and clarity by gastroenterologists familiar with routine and high-volume endoscopy practice. Formal quantitative content validity indices, such as item-level or scale-level content validity index calculations, were not performed. The module was pilot-tested with 10 gastroenterologists for clarity and face validity. Pilot feedback led to minor wording refinements to improve clarity; no items were added or removed. Pilot responses were excluded from the analytic dataset.

The module assessed weekly endoscopic procedure volume, number of half-day endoscopy sessions, frequency of list overruns, proportion of therapeutic or advanced procedures, proportion of emergency or unscheduled procedures, out-of-hours endoscopy duty, frequency of after-hours work-related communication, physical exhaustion after endoscopy days, perceived documentation burden, perceived adequacy of endoscopy unit staff support, perceived workload fairness, and access to institutional psychological support. Response formats included numeric entry, categorical choices, and five-point Likert-type scales. Because the module was designed to measure distinct workload exposures rather than a latent psychometric construct, no composite score was calculated; each item was analysed individually.

Analytic thresholds were selected a priori to represent clinically interpretable workload categories and are also reported in the Supplementary material. Monthly on-call frequency was examined across ordered categories for trend analyses and was dichotomised as six or more *vs* fewer than six monthly shifts for regression modelling. Weekly endoscopy volume was dichotomised as more than 60 *vs* 60 or fewer procedures per week. Weekly outpatient clinic burden was dichotomised as six or more *vs* fewer than six sessions per week. Weekly endoscopy sessions were dichotomised as six or more *vs* fewer than six half-day sessions. List overrun frequency was coded as at least once weekly *vs* less frequent. Emergency or unscheduled procedures were coded as 10% or more *vs* less than 10% of total endoscopy workload. Out-of-hours endoscopy duty and institutional psychological support were coded as present *vs* absent. Five-point Likert-type responses were dichotomised by grouping unfavourable response categories, such as frequent/very frequent after-hours communication or inadequate/very inadequate staff support, against all remaining categories. The complete questionnaire took approximately 12 minutes to complete.

Because procedure volume alone may not fully capture procedural complexity, duration, or physical and cognitive load, the module also included items on therapeutic or advanced procedure proportion and emergency or unscheduled procedure proportion. These variables were analysed individually and were not combined with total procedure volume into a composite workload score.

Outcomes

The primary outcomes were the continuous CBI personal, work-related, and patient-related burnout scores, along with the binary indicator of clinically relevant burnout, defined as a score of 50 or higher, in each domain. For multivariable modelling, clinically relevant personal burnout was selected as the main binary outcome because it captures general exhaustion and was considered most directly aligned with the workload exposures under investigation. This choice was prespecified because personal burnout reflects overall exhaustion without requiring respondents to attribute exhaustion specifically to work or patient care, thereby reducing conceptual overlap between occupational exposures and the outcome definition. Work-related and patient-related burnout were analysed as secondary outcomes using continuous scores, group comparisons, correlation analyses, and exploratory domain-specific sensitivity models. Secondary outcomes comprised intention to reduce clinical workload within the following 1-2 years and stress-related consideration of leaving the current hospital, the specialty of gastroenterology, the medical profession, or the country.

Statistical analysis

Categorical variables are summarised as *n* (%). Continuous variables, which deviated from normality according to the Shapiro-Wilk test, are presented as medians and interquartile ranges (IQRs). Group comparisons were performed using the Mann-Whitney *U* test or the Kruskal-Wallis test, as appropriate; significant Kruskal-Wallis tests were followed by Dunn's *post-hoc* pairwise comparisons. Trends across ordered categories of monthly on-call frequency were examined with the Jonckheere-Terpstra test.

Spearman rank correlation coefficients were calculated to explore associations between workload variables and CBI subscale scores. Additional exploratory comparisons were performed to describe whether fellows, specialists completing obligatory service, specialists who had completed obligatory service, and academic faculty differed in selected workload exposures, including monthly on-call burden, weekly endoscopy volume, out-of-hours endoscopy duty, and public sector practice.

Multivariable logistic regression was employed to identify factors independently associated with clinically relevant personal burnout. Candidate variables were selected from demographic, professional, organisational, and endoscopy-specific variables considered clinically relevant before modelling. These included age, sex, marital status, dependents requiring care, years of professional experience, professional status, public sector practice, monthly on-call burden, out-

of-hours endoscopy duty, weekly endoscopy volume, weekly outpatient session burden, list overrun frequency, after-hours work-related communication, documentation burden, and perceived endoscopy unit staff support. Variables were considered for the multivariable model if they were clinically relevant and/or showed univariable associations at $P < 0.10$. Institutional psychological support was not entered into the model because only six respondents reported its availability, precluding meaningful estimation.

Collinearity among candidate variables was assessed before model entry using variance inflation factors and tolerance values. Variables with substantial conceptual overlap were not entered simultaneously into the same model. A variance inflation factor greater than 5 or tolerance lower than 0.20 was considered evidence of problematic collinearity. Model calibration was assessed using the Hosmer-Lemeshow goodness-of-fit test, and discrimination was assessed using the area under the receiver operating characteristic curve. Adjusted odds ratios (ORs) with 95% confidence intervals (CIs) are presented. Interaction terms, including on-call burden × out-of-hours endoscopy duty, were explored where clinically plausible.

Because the binary outcome was common, ORs were interpreted as measures of association rather than risk ratios and may overestimate the magnitude of associations. To address this issue, sensitivity analyses were performed using continuous personal burnout scores as the outcome and modified Poisson regression with robust standard errors to estimate prevalence ratios. Additional exploratory models were fitted for work-related and patient-related burnout to evaluate whether the direction of associations was consistent across CBI domains. All tests were two-sided, and $P < 0.05$ was considered statistically significant. No imputation was performed for missing data; denominators are reported for each variable whenever item-level missingness occurred. Analyses were performed using SPSS version 26.0 (IBM Corp., Armonk, NY, United States) and R version 4.2.0 (R Foundation for Statistical Computing, Vienna, Austria).

Sample size and precision

No formal a priori sample size calculation was carried out, as this was an exploratory national survey aiming to describe burnout burden and workload-related factors among gastroenterology physicians. Given the recruitment strategy, which relied on professional networks and snowball sampling, the estimates obtained should be regarded as descriptive survey estimates rather than probability-based population prevalence estimates. The number of predictors in the multivariable model was restricted to reduce the risk of overfitting, and the regression findings should be interpreted as explanatory associations rather than as a prediction model or causal estimates.

RESULTS

The final analytic sample comprised 278 consenting, non-retired gastroenterology physicians who fulfilled all eligibility criteria (Figure 1). Because item-level missingness varied across survey items, all percentages are reported using the available denominator for the respective variable. All proportions should be interpreted as descriptive findings among respondents rather than as probability-based national prevalence estimates.

Participant characteristics

Table 1 presents the demographic and professional characteristics of the respondents. The majority were male (196/278, 70.5%), married (230/278, 82.7%), had at least one dependent requiring care (224/278, 80.6%), and were between 30 years and 50 years of age (248/278, 89.2%). Gastroenterology fellows constituted 82/278 (29.5%) of the sample; 42/278 (15.1%) were specialists in the process of completing obligatory service, 92/278 (33.1%) were specialists who had already fulfilled this requirement, and 62/278 (22.3%) were academic faculty. Public sector employment was reported by 246/278 respondents (88.5%). General gastroenterology represented the primary clinical focus for 148/278 respondents (53.2%), followed by mixed practice (92/278, 33.1%) and other or subspecialty-focused practice (38/278, 13.7%).

Endoscopy workload and organisational support

Table 2 summarises workload indicators and perceived organisational support. Weekly working hours exceeding 80 hours were reported by 64/276 respondents (23.2%), and 154/276 (55.8%) had six or more monthly on-call shifts. High endoscopy volume was common: 130/278 respondents (46.8%) performed more than 60 endoscopic procedures per week, and 168/278 (60.4%) conducted six or more half-day endoscopy sessions weekly. Endoscopy list overruns occurring at least once per week were reported by 150/274 respondents (54.7%), while 120/274 (43.8%) indicated that emergency or unscheduled procedures accounted for at least 10% of their total endoscopic workload. Out-of-hours endoscopy duty was reported by 70/276 respondents (25.4%).

Endoscopy-related physical and psychological strain was prevalent. Physical exhaustion following endoscopy days was reported by 194/272 respondents (71.3%). Frequent or very frequent after-hours work-related communication was reported by 200/278 (71.9%). Work-life conflict was reported by 210/278 respondents (75.5%), and 220/278 (79.1%) indicated having insufficient energy after work for personal or family activities. Inadequate staffing support within the endoscopy unit was reported by 150/278 respondents (54.0%). Only 6/278 respondents (2.2%) reported access to institutional psychological support services.

CBI scores

CBI subscale scores are displayed in Table 3. Median scores were 71 (IQR: 59-83) for personal burnout, 70 (IQR: 57-82) for work-related burnout, and 64 (IQR: 50-76) for patient-related burnout. Among the respondents, 221/278 (79.5%) had a

Table 1 Demographic and professional characteristics of respondents

Characteristic	*n*/*N* (%)
Age group	
< 30 years	2/278 (0.7)
30-40 years	136/278 (48.9)
41-50 years	112/278 (40.3)
51 years or older	28/278 (10.1)
Sex	
Female	80/278 (28.8)
Male	196/278 (70.5)
Prefer not to say	2/278 (0.7)
Married	230/278 (82.7)
Dependents requiring care, one or more	224/278 (80.6)
Professional status	
Gastroenterology fellows	82/278 (29.5)
Specialists completing obligatory service	42/278 (15.1)
Specialists who completed obligatory service	92/278 (33.1)
Academic faculty	62/278 (22.3)
Public sector practice	246/278 (88.5)
Clinical focus	
General gastroenterology	148/278 (53.2)
Mixed practice	92/278 (33.1)
Other or subspecialty-focused practice	38/278 (13.7)

Percentages were calculated using the available denominator for each variable. For all variables shown in this table, the denominator was 278. "Dependents requiring care" indicates the presence of at least one dependent requiring care. Clinical focus categories are mutually exclusive. "Other or subspecialty-focused practice" includes advanced endoscopy, inflammatory bowel disease, hepatology, or other focused practice areas.

personal burnout score of 50 or higher, 217/278 (78.1%) had a work-related burnout score of 50 or higher, and 194/278 (69.8%) had a patient-related burnout score of 50 or higher. These proportions describe the frequency of high burnout scores in this self-selected respondent sample and are not intended as unbiased national prevalence estimates. Academic faculty members exhibited significantly higher work-related burnout scores than fellows in *post-hoc* comparison (P = 0.04). Respondents working in the public sector had higher scores across all three CBI domains compared with those in non-public practice (all P < 0.001). The internal consistency of the CBI in this sample was high, with Cronbach's alpha values of 0.89 for personal burnout, 0.87 for work-related burnout, and 0.84 for patient-related burnout.

On-call frequency and personal burnout

Personal burnout increased in a stepwise manner with rising monthly on-call frequency (Figure 2). Median personal burnout scores rose from 54 among respondents without on-call duties to 92 among those reporting 16 or more monthly on-call shifts. The proportion of respondents meeting the 50-or-higher threshold increased from 58.3% to 95.0% across these same categories. The Jonckheere-Terpstra test confirmed a statistically significant dose-response trend for both continuous personal burnout scores and the binary burnout indicator (P for trend < 0.001 for each).

Factors independently associated with clinically relevant personal burnout

In the multivariable logistic regression model, which was adjusted for age, marital status, presence of dependents, and years of professional experience, five factors were independently associated with clinically relevant personal burnout (Figure 3). These were six or more monthly on-call shifts (adjusted OR = 4.82, 95%CI: 2.91-7.98), out-of-hours endoscopy duty (adjusted OR = 3.45, 95%CI: 2.10-5.67), more than 60 endoscopic procedures per week (adjusted OR = 2.91, 95%CI: 1.82-4.66), perceived inadequate endoscopy unit staff support (adjusted OR = 2.68, 95%CI: 1.65-4.35), and six or more weekly outpatient clinic sessions (adjusted OR = 2.40, 95%CI: 1.48-3.90). Female sex showed a non-significant trend towards higher odds of clinically relevant personal burnout (adjusted OR = 1.68, 95%CI: 0.98-2.88; P = 0.058). Institutional psychological support could not be entered into the model because only six respondents reported its availability,

Table 2 Endoscopy workload and organisational support indicators

Parameter	*n*/*N* (%)
Weekly working hours more than 80 hours	64/276 (23.2)
Monthly on-call shifts, six or more	154/276 (55.8)
Weekly endoscopy volume more than 60 procedures/week	130/278 (46.8)
Weekly endoscopy sessions, six or more half-day units	168/278 (60.4)
Endoscopy list overruns at least once weekly	150/274 (54.7)
Emergency/unscheduled procedures, 10% or more of endoscopy workload	120/274 (43.8)
Out-of-hours endoscopy duty	70/276 (25.4)
Endoscopy days physically exhausting	194/272 (71.3)
Frequent/very frequent after-hours work communication	200/278 (71.9)
Work-life conflict	210/278 (75.5)
Insufficient post-work energy for personal or family activities	220/278 (79.1)
Inadequate endoscopy unit staff support	150/278 (54.0)
Reported access to institutional psychological support	6/278 (2.2)

Denominators vary because of item-level missingness. Endoscopy sessions refer to half-day endoscopy units. Endoscopy list overruns indicate lists exceeding scheduled time at least once weekly. Emergency or unscheduled procedures refer to respondents reporting that these procedures constituted 10% or more of their total endoscopy workload. Institutional psychological support refers to respondents' perceived access to psychological support through their institution.

Table 3 Copenhagen Burnout Inventory scores by professional status and practice setting

Group	*n*	Personal burnout, median (IQR)	Work-related burnout, median (IQR)	Patient-related burnout, median (IQR)
All respondents	278	71 (59-83)	70 (57-82)	64 (50-76)
Gastroenterology fellows	82	72 (60-84)	68 (55-80)	65 (50-78)
Specialists completing obligatory service	42	68 (54-80)	68 (54-80)	60 (46-72)
Specialists who completed obligatory service	92	70 (58-82)	70 (56-82)	62 (48-74)
Academic faculty	62	74 (62-86)	74 (60-86)[a]	68 (52-80)
Public sector	246	74 (62-86)[b]	72 (58-84)[b]	66 (52-78)[b]
Non-public practice	32	58 (46-70)	60 (48-72)	52 (40-64)
CBI score of 50 or higher, *n*/*N* (%)	-	221/278 (79.5)	217/278 (78.1)	194/278 (69.8)

[a]$P = 0.04$ for the *post-hoc* comparison of work-related burnout between academic faculty and gastroenterology fellows.
[b]$P < 0.001$ for public sector *vs* non-public practice for the corresponding Copenhagen Burnout Inventory domain. The threshold-based burnout row was not included in the group comparisons shown in this table.
Copenhagen Burnout Inventory (CBI) subscale scores are presented as median (interquartile range) and were transformed to a 0-100 scale, with higher scores indicating greater burnout. The threshold-based burnout row presents the proportion of respondents with CBI subscale scores of 50 or higher and should not be interpreted as an unbiased national prevalence estimate. Rows for professional status and practice setting represent separate stratifications.
CBI: Copenhagen Burnout Inventory; IQR: Interquartile range.

precluding meaningful estimation.

No candidate variable showed problematic multicollinearity in the variance inflation factor assessment; all variance inflation factors were below 2.5. The Hosmer-Lemeshow goodness-of-fit test indicated acceptable model calibration ($P = 0.67$), and the area under the receiver operating characteristic curve was 0.84, indicating good discrimination.

Because the binary outcome was common, ORs were interpreted as measures of association rather than risk ratios. Sensitivity analyses using linear regression with continuous personal burnout score as the outcome and modified Poisson regression estimating prevalence ratios yielded a consistent pattern of associations, although the prevalence ratios were smaller in magnitude than the corresponding ORs (Supplementary Table 1). Exploratory models for work-related and

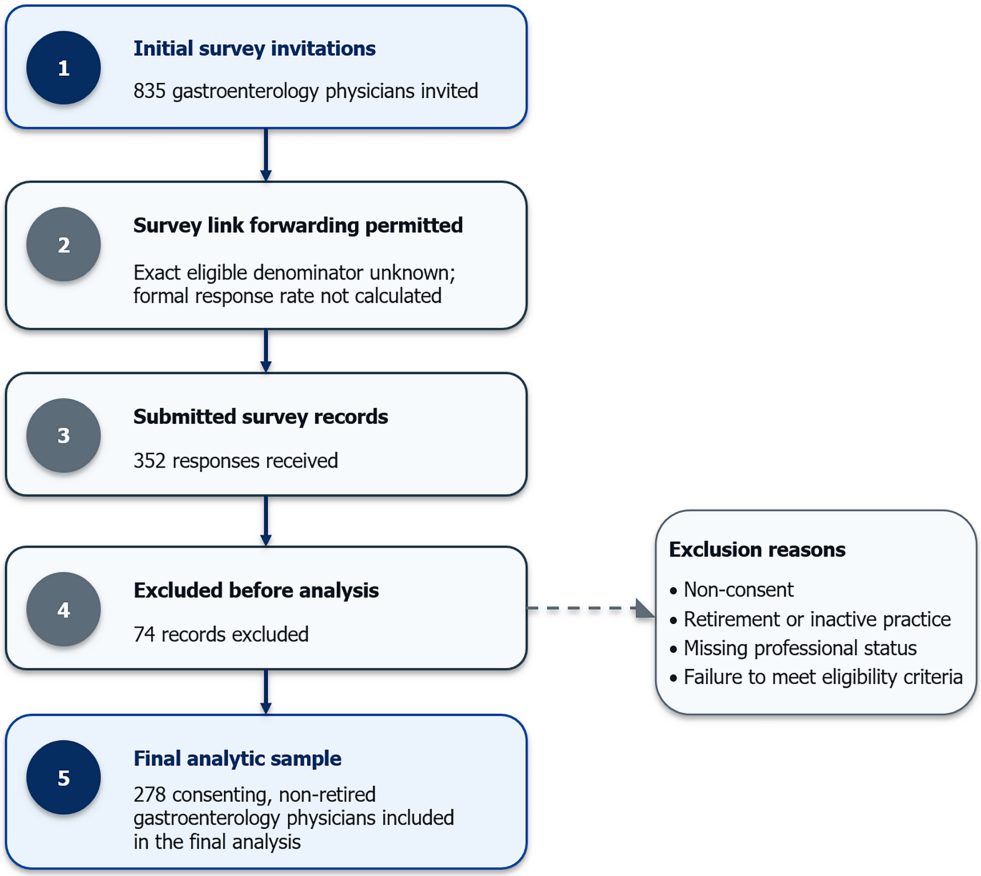

Figure 1 Participant recruitment and analytic sample. Flow diagram showing participant recruitment and inclusion in the final analytic sample. Initial invitations were sent to 835 gastroenterology physicians. Because forwarding of the survey link was permitted, the exact eligible denominator could not be determined and a formal response rate could not be calculated. Of 352 submitted survey records, 278 consenting, non-retired physicians who were actively practising gastroenterology and met all eligibility criteria were included in the final analysis.

patient-related burnout showed similar directions of effect for the main workload variables.

Correlations and exploratory analyses

Spearman correlation analyses demonstrated consistent positive associations between workload variables and all three CBI subscale scores (Table 4). Monthly on-call frequency showed the strongest correlation with personal burnout (*rho* = 0.72), whereas endoscopy list overrun frequency was most strongly correlated with patient-related burnout (*rho* = 0.71). Work-life balance and perceived adequacy of staff support were inversely correlated with every burnout domain. All reported correlations were significant at $P < 0.001$.

In exploratory comparisons across professional status, monthly on-call frequency varied across groups (overall $P = 0.008$), with fellows showing a higher median on-call frequency than specialists who had completed obligatory service (8 shifts *vs* 5 shifts). Public sector practice also differed across groups (overall $P = 0.002$), with the highest proportions observed among fellows and specialists completing obligatory service. Specialists completing obligatory service had endoscopy volumes comparable to fellows, while inadequate staff support was numerically more frequent in this group. These subgroup analyses were used to contextualise burnout patterns and should not be interpreted as evidence of causal differences between career stages (Supplementary Table 2).

In exploratory subgroup analyses, respondents who reported a very high on-call burden, defined as 11 or more shifts per month, together with out-of-hours endoscopy duty appeared to constitute a subgroup with particularly elevated personal burnout (median: 90, IQR: 82-96). However, given the cross-sectional design and the limited size of this subgroup, this observation should be regarded strictly as hypothesis-generating.

Career-related consequences

Career-related consequences were common among respondents. A total of 156/278 (56.1%) expressed an intention to reduce their clinical workload within the subsequent 1-2 years, and 144/278 (51.8%) reported having considered leaving their current hospital because of occupational stress. Stress-related consideration of leaving the country was reported by 132/278 (47.5%), while 118/278 (42.4%) had contemplated leaving the medical profession altogether. Furthermore, 72/278 (25.9%) had considered leaving the specialty of gastroenterology, and 54/278 (19.4%) stated that they would probably or definitely not choose gastroenterology again if given the opportunity to revisit their career decision.

Table 4 Spearman correlations between workload variables and Copenhagen Burnout Inventory subscale scores

Variable	Personal burnout	Work-related burnout	Patient-related burnout
Monthly on-call frequency	0.72	0.68	0.55
Weekly endoscopy volume	0.65	0.70	0.60
Endoscopy list overrun frequency	0.61	0.66	0.71
After-hours work communication frequency	0.59	0.64	0.52
Weekly working hours	0.58	0.62	0.48
Perceived staff support	-0.55	-0.60	-0.49
Work-life balance	-0.68	-0.74	-0.56

Values represent Spearman's rank correlation coefficients. Positive coefficients indicate higher burnout scores with increasing workload or burden. Negative coefficients for perceived staff support and work-life balance indicate lower burnout scores among respondents reporting more favourable organisational conditions. All correlations were statistically significant at $P < 0.001$.

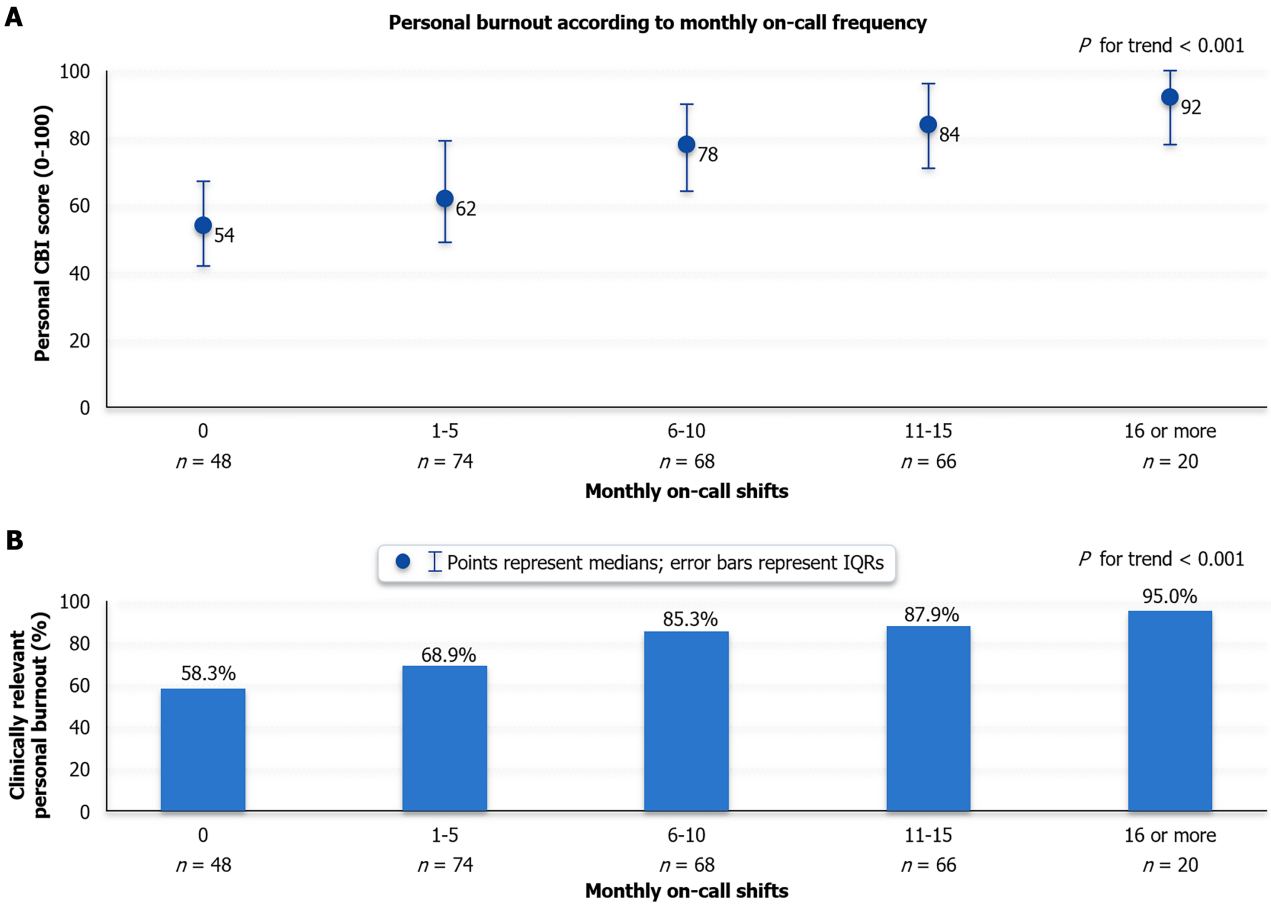

Figure 2 Personal burnout according to monthly on-call frequency. Personal burnout increased progressively across categories of monthly on-call frequency. A: Median personal burnout scores; B: The proportion of respondents with clinically relevant personal burnout across ordered on-call categories. Clinically relevant personal burnout was defined as a personal Copenhagen Burnout Inventory score of 50 or higher. Trends across monthly on-call categories were statistically significant for both personal burnout score and the proportion of respondents with a personal burnout score of 50 or higher (P for trend < 0.001 for both). CBI: Copenhagen Burnout Inventory; IQRs: Interquartile ranges.

DISCUSSION

In this national cross-sectional survey, responding gastroenterology specialists and fellows in Türkiye reported high burnout scores across all three CBI domains, and a distinct set of modifiable, endoscopy-specific workload factors were independently associated with clinically relevant personal burnout. The graded relationship between on-call frequency and burnout, the independent associations of procedural volume and out-of-hours duties, and the near absence of institutional psychological support point to system-level challenges that extend well beyond individual coping.

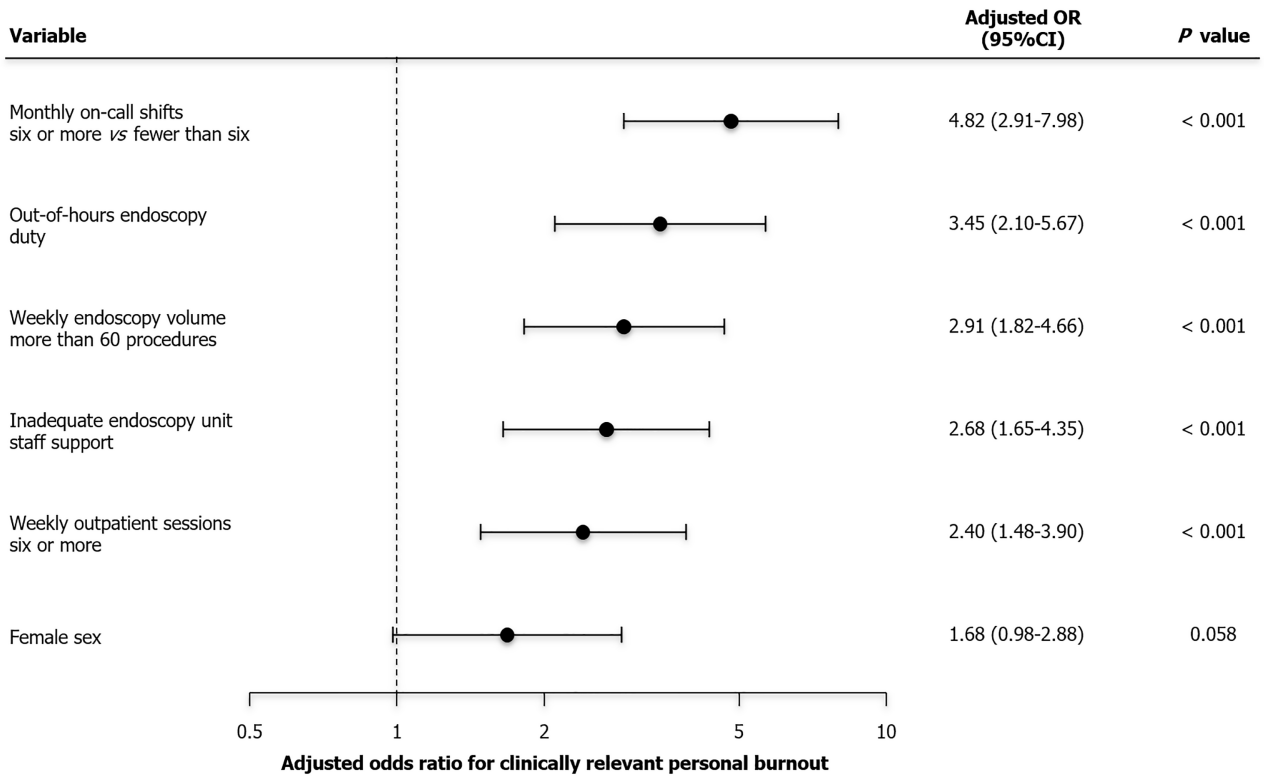

Figure 3 Factors associated with clinically relevant personal burnout. Forest plot displaying adjusted odds ratios and 95% confidence intervals for factors independently associated with clinically relevant personal burnout in multivariable logistic regression. Clinically relevant personal burnout was defined as a personal Copenhagen Burnout Inventory score of 50 or higher. The model included monthly on-call burden (six or more *vs* fewer than six shifts per month), out-of-hours endoscopy duty, weekly endoscopy volume (more than 60 *vs* 60 or fewer procedures per week), inadequate endoscopy unit staff support, weekly outpatient session burden (six or more *vs* fewer than six sessions per week), and female sex, and was adjusted for age, marital status, dependents, and years of professional experience. The dashed vertical line denotes an odds ratio of 1. CI: Confidence interval; OR: Odds ratio.

The proportion of respondents meeting the 50-or-higher CBI threshold was high, but these figures must be interpreted with considerable caution and should not be taken as national prevalence estimates. The recruitment strategy - professional networks and snowball sampling - precluded calculation of a formal response rate and may have overrepresented physicians experiencing greater occupational strain. This sampling approach carries an additional risk: Physicians with burnout may have been more motivated to complete the survey, which could inflate descriptive burnout estimates and potentially strengthen the perceived magnitude of workload associations. Consequently, the absolute percentages reported here describe burnout levels within this self-selected sample and cannot be generalized to the entire Turkish gastroenterology workforce. Direct comparison with the pooled burnout prevalence from a recent global meta-analysis [13] is therefore problematic, as estimates vary according to instrument, cut-off definition, sampling method, and healthcare system context. The value of this study lies not in the absolute prevalence figures but in the consistent pattern of associations between specific workload characteristics and burnout.

The strongest independent association was observed for monthly on-call frequency. A graded, stepwise increase in personal burnout was evident across ordered on-call categories, and having six or more monthly on-call shifts was associated with a nearly fivefold increase in the odds of clinically relevant personal burnout. Repeated on-call exposure may contribute to cumulative fatigue, disrupted sleep, and insufficient inter-shift recovery-core mechanisms within recovery-based models of occupational stress[20,21]. The exploratory observation that respondents with very high on-call burdens and concomitant out-of-hours endoscopy constituted a subgroup with particularly elevated burnout scores is consistent with these models; however, given the cross-sectional design and small subgroup size, this finding remains strictly hypothesis-generating.

Beyond on-call burden, the endoscopy workload module provided specialty-specific insights that are not captured by total weekly working hours. High weekly endoscopic volume and out-of-hours endoscopy duty were independently associated with clinically relevant personal burnout, whereas list overrun frequency and after-hours work-related communication were positively correlated with CBI scores. These associations are clinically plausible but should be interpreted as associations rather than causal effects. Endoscopy demands sustained concentration, fine motor precision, rapid decision-making, and continuous responsibility for patient safety; when performed under time pressure and without adequate recovery intervals, such demands may contribute to both psychological strain and potential threats to service quality[22]. Moreover, procedure volume alone does not fully capture the physical and cognitive load of endoscopy. Therapeutic and advanced procedures, which often involve longer duration, greater complexity, and higher clinical stakes, may contribute disproportionately to procedural fatigue, a dimension that deserves attention in high-volume settings[23]. List overrun frequency was positively correlated with burnout scores, especially patient-related

burnout, suggesting that the spillover of scheduled work into intended recovery time warrants attention. Similarly, frequent after-hours work-related communication may blur the boundaries between professional and personal life, further limiting opportunities for psychological detachment. This interpretation is consistent with broader physician workforce evidence showing that burnout is closely linked to reduced satisfaction with work-life integration[24].

The finding that fellows reported higher on-call frequency than senior specialists and were disproportionately exposed to public-sector obligations provides useful context for interpreting burnout patterns by career stage. These subgroup findings should not be interpreted causally, but they suggest that early-career gastroenterologists may experience a distinct combination of procedural exposure, emergency responsibilities, administrative burden, and limited recovery time. This interpretation is consistent with broader evidence from procedure-based training environments showing that procedural exposure, administrative workload, and perceived free time shape training experience and professional well-being[25].

The inverse associations observed between perceived staff support, work-life balance, and all three burnout domains reinforce the understanding that burnout is shaped substantially by organisational conditions. More than half of the respondents perceived endoscopy unit staffing as inadequate, and only 2.2% reported access to institutional psychological support. The near absence of such support is striking, particularly given the high frequency of career-related consequences: More than half of the participants intended to reduce their clinical workload within the next 1-2 years or had considered leaving their current hospital, and nearly half had considered leaving the country or the medical profession altogether. These figures point to a workforce sustainability challenge that extends beyond individual well-being, consistent with evidence linking work overload to both burnout and intention to leave employment[26]. Public sector physicians reported significantly higher burnout scores than their non-public counterparts, possibly reflecting higher patient throughput, greater procedural volume, more frequent emergency duties, mandatory service obligations, and more limited administrative and personnel support.

Several concrete implications follow from these findings. First, routine occupational health surveillance in gastroenterology should integrate validated burnout assessments with monitoring of endoscopy-specific workload indicators, particularly on-call schedules, out-of-hours procedural duties, list overruns, after-hours communication, documentation burden, and staffing adequacy. Second, endoscopy unit capacity planning should move beyond simple procedure counts to incorporate case complexity, recovery time, staffing levels, and the cumulative burden of unscheduled emergency work. Third, hospital-level interventions could include protected recovery time after emergency endoscopy, limits on consecutive on-call duties, formal out-of-hours endoscopy pathways, improved nursing and ancillary staffing, and protected administrative time for documentation and follow-up. Streamlined documentation processes and confidential, easily accessible psychological support services should also be considered. These measures are consistent with organisation-directed interventions identified in systematic reviews and recent gastroenterology-specific recommendations [27-29].

This study has several strengths. It is the first national survey in Türkiye to examine burnout among gastroenterologists and gastroenterology fellows using the CBI in conjunction with a dedicated endoscopy workload module. The sample spanned career stages and practice settings, and the survey captured nuanced procedural and organisational exposures beyond generic work hours. The inclusion of sensitivity analyses with continuous burnout scores and alternative regression approaches, as well as transparent reporting of model calibration and discrimination, strengthens confidence in the direction of the reported associations. At the same time, because the binary outcome was common, the ORs should be interpreted as measures of association and not as risk ratios.

Several limitations must be acknowledged. First, the cross-sectional design precludes causal inference; the reported associations indicate relationships, not causation. Second, self-reported data are susceptible to recall and social desirability biases. Third, physicians experiencing burnout may have been more motivated to complete the survey, which may have inflated the descriptive frequency of high burnout scores and may also have strengthened perceived associations between workload and burnout. The snowball recruitment strategy also limits the generalisability of the observed proportions and prevents interpretation as national prevalence estimates. Fourth, the endoscopy workload module, although developed with expert input and pilot-tested for clarity and face validity, is not a formally validated psychometric scale; formal quantitative content validity indices were not calculated, and its items were therefore analysed individually. Fifth, objective indicators of endoscopy quality, staffing records, or administrative workload logs were not collected, so self-reported workload could not be corroborated. Finally, the CBI cut-off of 50 or higher, while widely used internationally, has not been specifically validated among Turkish gastroenterologists. We therefore treated this threshold as a descriptive benchmark for comparability rather than as a diagnostic criterion for burnout, and we consistently complemented threshold-based analyses with continuous score analyses, correlations, and sensitivity analyses. The consistency of findings across these approaches supports the robustness of the observed associations irrespective of the chosen cut-off.

Future longitudinal studies are needed to determine whether interventions that reduce excessive on-call frequency, restructure endoscopy scheduling to minimise list overruns, strengthen nursing and ancillary staffing, provide protected administrative time, reduce documentation burden, and establish dedicated out-of-hours endoscopy pathways can lead to measurable improvements in burnout, workforce retention, and patient outcomes. Linking burnout measures with objective endoscopy quality indicators - such as adenoma detection rate, caecal intubation rate, complication records, procedure duration, and patient experience - would further clarify the clinical and operational implications of these findings.

CONCLUSION

Among responding gastroenterology specialists and fellows in Türkiye, burnout scores were high across all CBI domains; however, these findings were obtained from a self-selected sample and should not be interpreted as causal effects or as national prevalence estimates. Clinically relevant personal burnout was independently associated with frequent on-call duty, out-of-hours endoscopy duty, high weekly endoscopic volume, perceived inadequate staff support, and high outpatient session burden. Correlation analyses additionally implicated list overruns and after-hours communication as workload features associated with higher burnout scores. The near absence of institutional psychological support and the high frequency of career-related consequences indicate that burnout in this population is not merely an individual concern but a system-level workforce and service-organisation issue. Targeted interventions - including restructuring on-call schedules with limits on consecutive duties, ensuring protected recovery time after emergency endoscopy, strengthening endoscopy unit staffing, providing protected administrative time, and embedding confidential psychological support within gastroenterology services - are likely to be necessary to safeguard physician well-being and sustain the quality of endoscopic care.

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FOOTNOTES

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Informed consent statement: All participants provided electronic informed consent before accessing the online questionnaire. Participation was voluntary and anonymous, and no personal identifiers were collected.

Conflict-of-interest statement: All the authors report no relevant conflicts of interest for this article.

Data sharing statement: The anonymised dataset supporting the findings of this study is available from the corresponding author upon reasonable request and subject to institutional ethics committee approval. The dataset is not publicly available because the survey

responses contain professional and organisational information that could potentially compromise participant anonymity.

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