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Original Article
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Evaluation of Burnout and Contributing Factors in Imaging Cardiologists in Korea

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ABSTRACT

Background: We aimed to examine the prevalence of burnout among imaging cardiologists in Korea and to identify its associated factors.
Methods: An online survey of imaging cardiologists affiliated with university hospitals in Korea was conducted using SurveyMonkey® in November 2023. The validated Korean version of the Maslach Burnout Inventory-Human Service Survey was used to assess burnout across three dimensions: emotional exhaustion, depersonalization, and lack of personal accomplishment. Data on demographics, work environment factors, and job satisfaction were collected using structured questionnaires.
Results: A total of 128 imaging cardiologists (46.1% men; 76.6% aged ≤ 50 years) participated in the survey. Regarding workload, 74.2% of the respondents interpreted over 50 echocardiographic examinations daily, and 53.2% allocated > 5 of 10 working sessions per week to echocardiographic laboratory duties. Burnout levels were high, with a significant proportion of participants experiencing emotional exhaustion (28.1%), depersonalization (63.3%), and a lack of personal accomplishment (92.2%). Younger age (< 50 years) was correlated with higher emotional exhaustion risk, while more research time was protective against burnout in the depersonalization domain. Factors, such as being single, living with family, and specific job satisfaction facets, including uncontrollable workload and value mismatch, were associated with varying levels of burnout risk across different dimensions.

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Disclosure

The authors have no potential conflicts of interest to disclose.

Data Availability Statement

The dataset generated and analysed during the present study is not publicly accessible due to protecting personal responses. Data are available on reasonable request: available from the author Cho DH (why012@gmail.com).

Author Contributions

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Conclusion: Our study underscores the high burnout rates among Korean imaging cardiologists, attributed to factors such as the subjective environment and job satisfaction. Hence, evaluating and supporting cardiologists in terms of individual values and subjective factors are important to effectively prevent burnout.

Keywords: Burnout; Echocardiography Specialists; Job Satisfaction; Emotional Exhaustion; Depersonalization; Korea

INTRODUCTION

The term “burnout” has gained widespread recognition, not only among the general public but also among healthcare professionals.[1,2] The World Health Organization defines burnout as “a syndrome conceptualized as resulting from chronic workplace stress that has not been successfully managed.”[3] The International Statistical Classification of Diseases and Related Health Problems, 11th revision, classifies it as an occupational phenomenon rather than a medical condition. Burnout is a prolonged response to job-related chronic emotional and interpersonal stressors and is characterized by three dimensions: 1) feelings of energy depletion or exhaustion, 2) increased mental distance from one’s job or feelings of negativism or cynicism related to one's job, and 3) reduced professional efficacy.[4] Issues in these three areas can lead to emotional and physical exhaustion related to one's work, eventually resulting in a cynical or negative attitude toward one's job.

A significant number of healthcare professionals appear to experience burnout symptoms.[2,5] Physician well-being is critical to ensuring high-quality patient care and maintaining a sustainable healthcare workforce.[6,7] Therefore, burnout among healthcare professionals can lead to poor clinical decision-making or critical medical errors, particularly in high-stakes specialties, such as cardiology.[1,8,9] Cardiology is characterized by demands for precision, rapid decision-making, and the management of complex clinical situations, often with patients' lives at stake.[8,10] These demands expose cardiologists to exceptionally high-stress levels on a continuous basis. Extensive research in this field has revealed alarming rates of burnout affecting 21–59% of cardiology professionals, such as cardiac invasive specialists working in catheterization/electrophysiology labs, pediatric cardiologists, cardiology residents, and cardiology fellows.[10-13] Moreover, a 2019 survey by the American College of Cardiology reported that more than a quarter of cardiologists (28%) experienced self-reported mental health conditions.[14] Regional disparities were evident, with the highest prevalence in South America (39.3%) and a comparatively lower rate in Asia (20.1%). This study reported that 4.7% of cardiologists had major depressive disorder or schizophrenia. Worryingly, 0.4% of the respondents reported having attempted suicide within the past year, underscoring the urgent need for targeted interventions to safeguard the mental well-being of cardiologists.

Given the high prevalence and severe consequences of burnout among cardiologists, it is crucial to understand the specific factors that contribute to burnout in this group. This study aimed to investigate the prevalence of burnout among imaging cardiologists in Korea, identify the associated demographic and environmental factors, and assess the impact of job satisfaction on burnout levels.

METHODS

Participants and data collection

We conducted an online survey targeting imaging cardiologists at university hospitals in Korea, who were members of the Korean Society of Echocardiography (KSE), with membership. The validated Korean version of the Maslach Burnout Inventory-Human Service Survey (MBI-HSS) was used.[15] Emails containing survey information were sent to KSE members, specifically addressing cardiologists specializing in echocardiography and affiliated with university hospitals. An invitation sent in November 2023 encouraged voluntary participation in the online survey.

Demographic and environmental factors

The survey assessed marital status, living arrangements (alone or with family), and exercise habits. Age was categorized into seven groups, with 5-year intervals, ranging from 30 to 65 years (30–35, 36–40, 41–45, 46–50, 51–55, 56–60, and 61–65 years). Various aspects of the working environment were examined, including the number of hospital beds; number of staff members responsible for the echocardiography laboratory; number of echocardiography machines; number of ultrasounds performed per day; number of working sessions in the echocardiographic laboratory per week; number of research sessions per week; on-call duty; number of vacation days per year; duty on Saturdays; presence of outpatient clinics; duty in the echocardiographic laboratory; and salary.

Burnout measurement

Burnout was assessed using the validated Korean version of the MBI-HSS,[15] which consists of 21 items divided into three subdimensions: emotional exhaustion, depersonalization, and lack of personal accomplishment, each consisting of seven items. Responses were recorded on a 7-point scale ranging from zero (no experience) to six (experiencing certain feelings, emotions, or thoughts at least six times a week).

The MBI-HSS is a widely used and extensively validated instrument for assessing burnout, particularly among healthcare professionals. It is recognized for its reliability across diverse healthcare settings, making it a standard tool in burnout research.[16-19] The MBI-HSS categorizes burnout levels into high, moderate, and low based on specific cut-off scores for each dimension. Emotional exhaustion is characterized by persistent fatigue and physical complaints extending beyond the workplace: low burnout is indicated by a score of ≤ 18; moderate burnout, 19–26; and high burnout, ≥ 27. Depersonalization refers to dehumanization or detachment from patients: low burnout is characterized by a score of ≤ 5; moderate burnout, 6–9; and high burnout, ≥ 10. Personal accomplishment reflects work-related fulfillment and experiencing a sense of accomplishment and satisfaction: low burnout is defined as a score of ≥ 40; moderate burnout, 34–39; and high burnout, ≤ 33. Higher emotional exhaustion and depersonalization scores indicate higher burnout levels, whereas lower personal accomplishment scores indicate higher burnout levels.

Here, the following scores were indicative of burnout: ≥ 27 in emotional exhaustion, ≥ 10 in depersonalization, and ≤ 33 in personal accomplishment. The cut-off scores used in this study are based on the most commonly adopted thresholds in the literature and have been widely cited.[20]

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Factors associated with job satisfaction

We included the following six items in the survey to assess job satisfaction on a 5-point scale with ratings of strongly agree, agree, neutral, disagree, and strongly disagree: work overload, control over workload, rewards, community, fairness, and value alignment within the working environment.

Statistical analyses

Categorical variables were presented as frequencies and percentages, whereas continuous variables, were as standard deviation. Bivariate analyses were conducted to examine the associations between variables using χ^2 and Fisher's exact tests. Mean differences were assessed using *t*-tests for two-category characteristics and analysis of variance for multicategory characteristics. Multivariate logistic regression analyses were conducted to identify risk factors associated with burnout. Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) were calculated to assess the strength and direction of the associations between predictor variables and burnout. Due to the limited sample size, logistic regression models were adjusted for age, which was a relevant factor in this study. Differences were evaluated for both clinical and statistical significance, which was set at $P < 0.05$. All analyses were performed using R software (R Foundation for Statistical Computing, Cary, NC, USA).

Ethics statement

Participants accessed the questionnaire after completing an informed consent form to ensure their voluntary participation. Due to the study's anonymous nature, participants could not be identified in accordance with the Institutional Review Board (IRB) protocol. The anonymous online survey was conducted via SurveyMonkey® (San Mateo, CA, USA) over a 1-week period from November 23 to 30, 2023. This study was approved by the Korea University Anam Hospital IRB (2023AN0560).

RESULTS

Participant characteristics

The survey was sent to 186 imaging cardiologists who were KSE members, and 135 responded (response rate, 72.5%). In total, 128 participants (46.1% men) who answered all survey questions were included in the analysis; 76.6% were aged ≤ 50 years. Among the respondents, 60.2% were certified as internal medicine specialists for > 10 years. While 57.8% were full-time professors, 32.8% and 9.4% were associate and assistant professors, respectively. Demographic characteristics are presented in **Table 1**. Geographically, participants were distributed across various regions nationwide, with 34.4% and 30.5% working in hospitals located in Seoul and Gyeonggi Province/Incheon Region, respectively, and 19.5% working in hospitals in Gyeongsang Province (**Supplementary Fig. 1** and **Supplementary Table 1**).

Working environment

The items presented in **Table 2** represent various aspects of the working environment. Most respondents worked in university hospitals with > 500 beds (93.0%), with a notable proportion (36.8%) working in hospitals with > 1,000 beds. Furthermore, 56.3% of the respondents practiced in facilities with 2–3 cardiologists specializing in echocardiography, and 54.7% had 5–10 echocardiography machines available. Regarding the workload in the echocardiography laboratory, 74.2% of the respondents interpreted > 50 echocardiographic examinations daily. More than half of the respondents (53.1%) allocated > 5 of 10 working

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Table 1. Demographic characteristics and general information of the participants

Variables	Total (N = 128)	No burnout or burnout in 1 dimension (n = 46)	Burnout in 2 dimensions (n = 49)	Burnout in 3 dimensions (n = 33)	*P* value
Gender					0.041
Men	59 (46.1)	25 (54.3)	24 (49.0)	10 (30.3)	
Women	69 (53.9)	21 (45.7)	25 (51.0)	23 (69.7)	
Age, yr					0.060
30–35	12 (9.4)	3 (6.5)	5 (10.2)	4 (12.1)	
36–40	34 (26.6)	11 (23.9)	15 (30.6)	8 (24.2)	
41–45	32 (25.0)	14 (30.4)	8 (16.3)	10 (30.3)	
46–50	20 (15.6)	3 (6.5)	8 (16.3)	9 (27.3)	
51–55	21 (16.4)	9 (19.6)	10 (20.4)	2 (6.1)	
56–60	6 (4.7)	3 (6.5)	3 (6.1)	0 (0.0)	
61–65	3 (2.3)	3 (6.5)	0 (0.0)	0 (0.0)	
Marital status					0.106
Single	25 (19.5)	7 (15.2)	6 (12.2)	12 (36.4)	
Married	103 (80.5)	39 (84.8)	43 (87.8)	21 (63.6)	
Living with family					0.215
No (living alone)	18 (14.1)	6 (13.0)	4 (8.2)	8 (24.2)	
Yes	110 (85.9)	40 (87.0)	45 (91.8)	25 (75.8)	
Exercise, yes[a]	76 (59.4)	31 (67.4)	28 (57.1)	17 (51.5)	0.149
Working period as a specialist in internal medicine, yr					0.344
1–5	15 (11.7)	7 (15.2)	5 (10.2)	3 (9.1)	
6–10	36 (28.1)	7 (15.2)	15 (30.6)	14 (42.4)	
11–15	33 (25.8)	14 (30.4)	13 (26.5)	6 (18.2)	
≥ 15	44 (34.4)	18 (39.1)	16 (32.7)	10 (30.3)	
Position					0.575
Full-time professor	74 (57.8)	25 (54.3)	32 (65.3)	17 (51.5)	
Clinical associate professor	42 (32.8)	15 (32.6)	12 (24.5)	15 (45.5)	
Clinical assistant professor	12 (9.4)	6 (13.0)	5 (10.2)	1 (3.0)	

Values are presented as number (%).
[a]Exercise for at least 1 hour per week.

sessions per week to these activities, with 9.4% engaging in > 7 weekly sessions. Research involvement varied, with 54.2% reporting having ≤ 3 research sessions per week and 14.8% reporting no participation in research sessions. Regarding annual leave, 39% of the respondents took ≤ 7 days off annually, whereas only 10.9% took > 2 weeks off annually.

Burnout levels

The median MBI-HSS scores for emotional exhaustion, depersonalization, and lack of personal accomplishment were 21.0 (12.75–28.0), 13.0 (7.00–20.00), and 23.0 (17.75–29.0), respectively (**Table 3** and **Supplementary Fig. 2**). A significant proportion of participants exhibited high burnout levels in each subdimension: 28.1% reported high emotional exhaustion; 63.3%, high depersonalization; and 92.2%, high levels of lack of personal accomplishment, which were defined as experiencing burnout in this study. Although there was a trend toward higher burnout prevalence among women (**Table 1**), this difference was not significant across the three burnout dimensions (**Fig. 1**). The proportion of participants who reported high burnout levels across two dimensions was 38.3%. Additionally, a quarter of the participants (25.8%) reported high burnout levels across all three dimensions (**Fig. 2**).

Association between age and burnout

Burnout prevalence across age groups peaked in the case of emotional exhaustion and depersonalization among individuals aged 45–50 years, followed by a decline among those aged ≥ 50 years (**Fig. 3**). Specifically, in the emotional exhaustion domain, 50.0% of individuals aged 46–50 years exhibited burnout, whereas only 9.5% of those aged 51–55 years exhibited burnout

Table 2. Working environment of the participants according to burnout dimensions

Variables	Total (N = 128)	No burnout or burnout in 1 dimension (n = 46)	Burnout in 2 dimensions (n = 49)	Burnout in 3 dimensions (n = 33)	*P* value
No. of hospital beds					0.586
< 500 beds	9 (7.0)	7 (15.2)	1 (2.0)	1 (3.0)	
500–1,000 beds	72 (56.3)	20 (43.5)	31 (63.3)	21 (63.6)	
1,000–1,500 beds	28 (21.9)	8 (17.4)	13 (26.5)	7 (21.2)	
1,500–2,000 beds	7 (5.5)	5 (10.9)	1 (2.0)	1 (3.0)	
≥ 2,000 beds	12 (9.4)	6 (13.0)	3 (6.1)	3 (9.1)	
No. of staff in charge of the echocardiography laboratory					
1	22 (17.2)	4 (8.7)	13 (26.5)	5 (15.2)	
2–3	72 (56.3)	25 (54.3)	26 (53.1)	21 (63.6)	
4–5	20 (15.6)	11 (23.9)	7 (14.3)	2 (6.1)	
≥ 6	14 (10.9)	6 (13.0)	3 (6.1)	5 (15.2)	
No. of echocardiography machines					0.513
< 5	21 (16.4)	9 (19.6)	9 (18.4)	3 (9.1)	
5–10	70 (54.7)	18 (39.1)	30 (61.2)	22 (66.7)	
10–15	23 (18.0)	12 (26.1)	7 (14.3)	4 (12.1)	
> 15	14 (10.9)	7 (15.2)	3 (6.1)	4 (12.1)	
No. of ultrasounds performed per day					0.981
< 50	33 (25.8)	14 (30.4)	14 (28.6)	5 (15.2)	
50–100	67 (52.3)	17 (37.0)	29 (59.2)	21 (63.6)	
100–200	15 (11.7)	9 (19.6)	3 (6.1)	3 (9.1)	
> 200	13 (10.2)	6 (13.0)	3 (6.1)	4 (12.1)	
No. of working sessions in the echocardiographic laboratory per week					
1–2	4 (3.1)	2 (4.3)	1 (2.0)	1 (3.0)	0.658
3–4	56 (43.8)	23 (50.0)	21 (42.9)	12 (36.4)	
5–6	56 (43.8)	16 (34.8)	21 (42.9)	19 (57.6)	
7–8	10 (7.8)	4 (8.7)	5 (10.2)	1 (3.0)	
9–10	2 (1.6)	1 (2.2)	1 (2.0)	0 (0.0)	
> 5 sessions	68 (53.1)	21 (45.6)	27 (55.1)	20 (60.6)	0.746
No. of research sessions per week					0.005
0	19 (14.8)	4 (8.7)	9 (18.4)	6 (18.2)	
1	34 (2.6)	8 (17.4)	15 (30.6)	11 (33.3)	
2	44 (34.4)	17 (37.0)	15 (30.6)	12 (36.4)	
3	22 (17.2)	12 (26.1)	7 (14.3)	3 (9.1)	
4	7 (5.5)	4 (8.7)	2 (4.1)	1 (3.0)	
≥ 5	2 (1.6)	1 (2.2)	1 (2.0)	0 (0.0)	
On-call duty					
No	41 (24.9)	16 (34.8)	18 (36.7)	7 (21.2)	0.243
Night shift	19 (14.8)	7 (15.2)	7 (14.3)	5 (15.2)	0.982
On-call intervention	25 (19.5)	8 (17.4)	9 (18.4)	8 (24.2)	0.471
On-call echocardiography	17 (13.3)	6 (13.0)	3 (6.1)	8 (24.2)	0.216
On-call medical consultation	63 (49.2)	20 (43.5)	22 (44.9)	21 (63.6)	0.095
No. of vacation days per year, days					0.046
< 5	15 (11.7)	4 (8.7)	4 (8.2)	7 (21.2)	
5–7	35 (27.3)	10 (21.7)	14 (28.6)	11 (33.3)	
8–10	41 (32.0)	18 (39.1)	17 (34.7)	6 (18.2)	
11–13	23 (18.0)	6 (13.0)	9 (18.4)	8 (24.2)	
≥ 14	14 (10.9)	8 (17.4)	5 (10.2)	1 (3.0)	
Duty on Saturday					
No	67 (52.3)	23 (50.0)	29 (59.2)	15 (45.5)	0.243
Outpatient clinic	36 (28.1)	10 (21.7)	15 (30.6)	11 (33.3)	0.243
Echocardiographic laboratory	38 (29.7)	15 (32.6)	11 (22.4)	12 (36.4)	0.833
Salary (1,000 won)					0.032
< 5,000	1 (0.8)	1 (2.2)	0 (0.0)	0 (0.0)	
5,000–10,000	81 (63.3)	25 (54.3)	31 (63.3)	25 (75.8)	
10,000–15,000	41 (32.0)	15 (32.6)	18 (36.7)	8 (24.2)	
15,000–20,000	5 (3.9)	5 (10.9)	0 (0.0)	0 (0.0)	
Teaching time per week, hr					0.717
< 1	48 (37.5)	18 (39.1)	20 (40.8)	10 (30.3)	
1–2	52 (40.6)	15 (32.6)	24 (49.0)	13 (39.4)	
2–3	19 (14.8)	9 (19.6)	3 (6.1)	7 (21.2)	
> 3	9 (7.0)	4 (8.7)	2 (4.1)	3 (9.1)	

Values are presented as number (%).

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Table 3. Frequency of burnout levels in the three subdimensions

Variables	Emotional exhaustion	Depersonalization	Lack of personal accomplishment
Score	21.0 (12.75–28.00)	13.0 (7.00–20.00)	23.0 (17.75–29.00)
No	0 (0.0)	8 (6.3)	0 (0.0)
Low	59 (46.1)	18 (14.1)	2 (1.6)
Moderate	33 (25.8)	21 (16.4)	8 (6.3)
High[a]	36 (28.1)	81 (63.3)	118 (92.2)

Values are presented as number (%). Scores are presented as mean and standard deviation.
[a]A high score in each subdimension was defined as burnout.

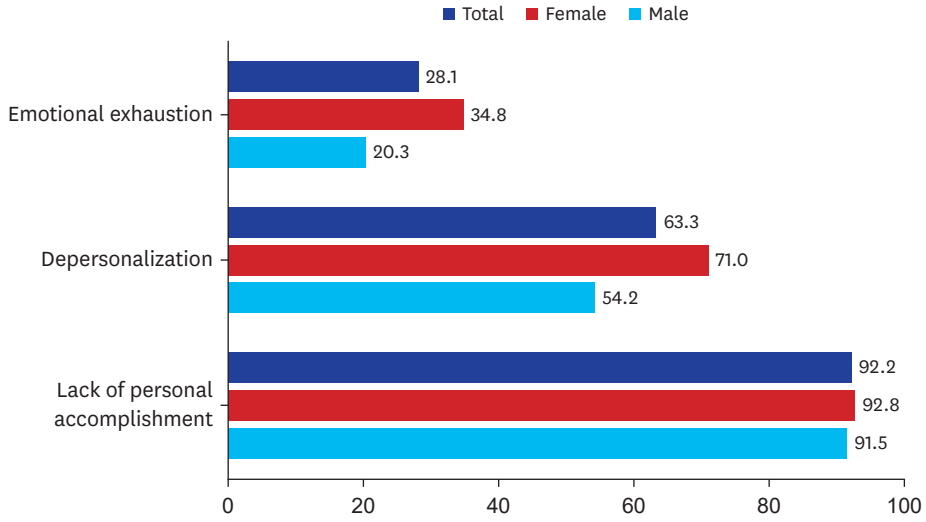

Fig. 1. Prevalence of high burnout levels across three dimensions according to gender among imaging cardiologists in Korea. Burnout levels are categorized as high, moderate, or low based on defined thresholds for each dimension according to the Maslach Burnout Inventory-Human Service Survey. Higher scores (≥ 27) in emotional exhaustion and (≥ 10) depersonalization indicate a high level of burnout, while lower scores (≤ 33) in personal accomplishment suggest a high level of burnout.

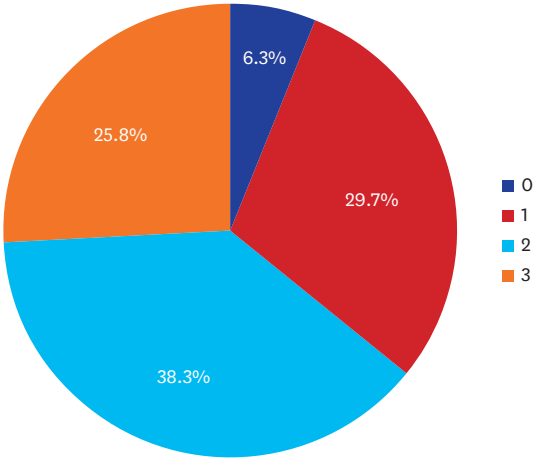

Fig. 2. Proportion of imaging cardiologists experiencing high burnout across multiple dimensions. The Maslach Burnout Inventory-Human Service Survey assesses burnout across three dimensions: emotional exhaustion, depersonalization, and lack of personal accomplishment.

(P = 0.006), with no reported cases of burnout among individuals aged ≥ 56 years. Respondents under 50 years had a significantly higher risk of emotional exhaustion than those over 50 years (OR, 7.44; 95% CI, 1.670–33.122; P = 0.008). In the depersonalization domain, burnout rates were 85% among those aged 46–50 years, decreasing sharply to 57.1% in the 51–55 age

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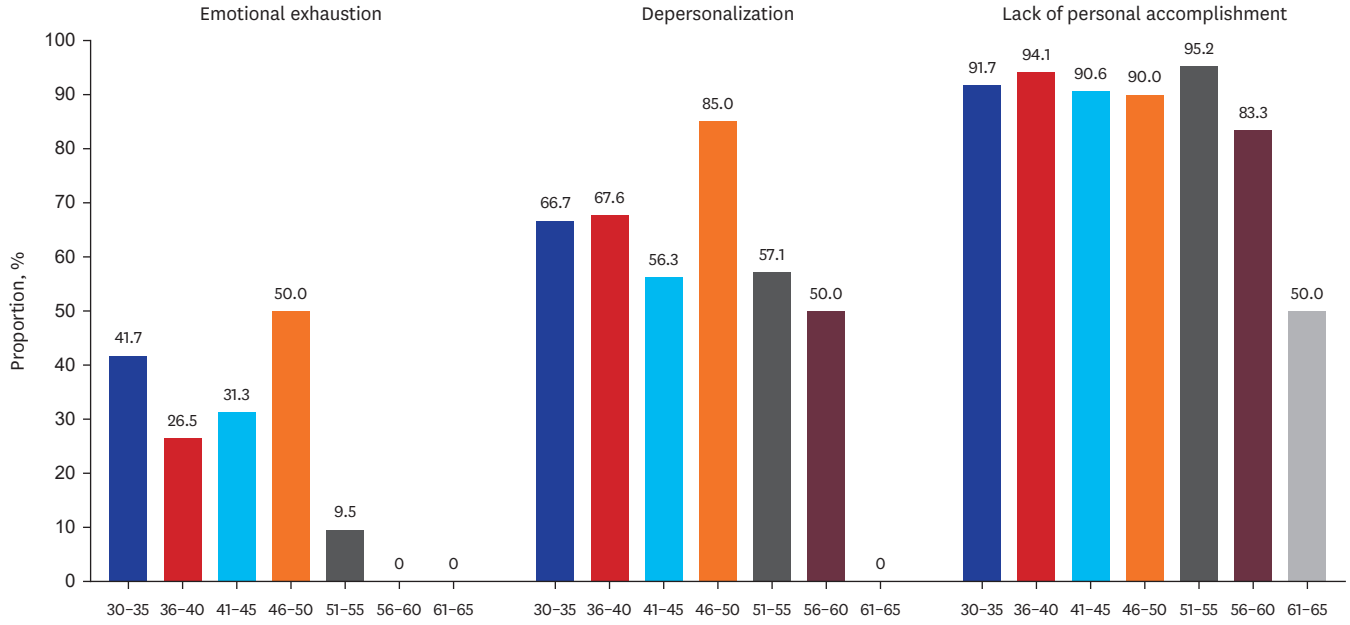

Fig. 3. Proportion of participants with high burnout levels across three dimensions by age groups.

group and further dropping to 50% in the 56–60 age group, with no cases among those aged ≥ 60 years, although this trend was not significant. Additionally, > 90% of respondents under 56 years met the burnout criteria for a lack of personal accomplishment (30–35 years, 91.7%; 36–40 years, 94.1%; 41–45 years, 90.6%; 46–50 years, 90.0%; 51–55 years, 95.2%). However, a decline was observed after the age of 56 (56–60 years, 83.3%; 60–65 years, 50.5%) (**Fig. 3**). Demographic characteristics by age are presented in **Supplementary Tables 2** and **3**.

Factors associated with burnout

Table 4 shows the results of the multivariate logistic regression analysis of the factors associated with burnout across each subdimension. Specifically, participants residing in a single state exhibited a significantly higher risk of emotional exhaustion-related burnout (adjusted OR, 3.41; 95% CI, 1.356–8.578). Conversely, a larger number of research sessions in the echocardiography laboratory was negatively correlated with depersonalization-related burnout (adjusted OR, 0.56; 95% CI, 0.394–0.805). Regarding lack of personal accomplishment, respondents living with family exhibited a notably higher burnout risk (adjusted OR, 5.24; 95% CI, 1.269–21.645), whereas those with increased teaching time per week exhibited a reduced risk (adjusted OR, 0.53; 95% CI, 0.308–0.909). Although there were significant differences in the annual number of vacation days and salary at baseline (**Table 1**), there was no significant association with burnout dimensions in the multivariable logistic regression analysis.

Association between job satisfaction and burnout

An examination of the six facets of job satisfaction—work overload, uncontrollable workload, unsatisfactory rewards, interpersonal conflict, unfairness, and value mismatch—revealed consistent associations with burnout across the three subdimensions. Specifically, uncontrollable workload and value mismatch were consistently correlated with burnout across all three subdimensions. Additionally, work overload and unfairness were associated with burnout in two subdimensions: emotional exhaustion and depersonalization. Unsatisfactory rewards were linked to emotional exhaustion, whereas interpersonal conflict was associated with depersonalization (**Table 4**).

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Table 4. Logistic regression

Variables	Coefficient	SE	Z	*P* value	Crude OR (95% CI)	Age-adjusted OR (95% CI)
Emotional exhaustion						
Age < 50 yr	2.0065	0.7621	2.633	0.008	7.44 (1.670–33.12)	
Marital status, single	1.3266	0.4650	2.853	0.004	3.77 (1.512–9.375)	3.41 (1.356–8.578)
Living with family	−0.8514	0.5224	−1.630	0.103	0.43 (0.153–1.188)	
No. of research sessions per week	−0.2574	0.1781	−1.445	0.148	0.77 (0.545–1.096)	
≥ 3 sessions	−0.6236	0.5049	−1.235	0.217	0.54 (0.199–1.442)	
Salary	−0.8073	0.3991	−2.023	0.043	0.34 (0.204–0.975)	0.53 (0.233–1.208)
Salary > 10 million won	−0.9014	0.4534	−1.988	0.047	0.41 (0.167–0.987)	0.51 (0.197–1.320)
Teaching time per week	0.2473	0.1900	1.302	0.193	1.28 (0.882–1.858)	
Job satisfaction						
Work overload	1.0574	0.3053	3.464	< 0.001	2.88 (1.583–5.237)	3.51 (1.798–6.853)
Uncontrollable workload	0.6376	0.2380	2.679	0.007	1.89 (1.187–3.016)	1.73 (1.058–2.834)
Unsatisfactory rewards	0.7175	0.2573	2.789	0.005	2.05 (1.238–3.393)	1.56 (1.025–2.387)
Interpersonal conflict	0.1654	0.2015	0.821	0.412	1.18 (0.795–1.751)	
Unfairness	0.6492	0.2305	2.816	0.005	1.91 (1.218–3.007)	2.00 (1.253–3.196)
Value mismatch	0.7746	0.2425	3.195	0.001	2.66 (1.610–4.402)	2.19 (1.347–3.574)
Depersonalization						
Age < 50 yr	0.7239	0.4240	1.708	0.088	2.063 (0.899–4.734)	
Marital status, single	0.4902	0.4892	1.002	0.316	1.63 (0.626–4.259)	
Living with family	−0.1726	0.5375	−0.321	0.748	0.84 (0.293–2.413)	
No. of research sessions per week	−0.5944	0.1789	−3.323	< 0.001	0.55 (0.389–0.784)	0.56 (0.394–0.805)
≥ 3 sessions	−1.3614	0.4315	−3.155	0.002	0.26 (0.110–0.597)	0.27 (0.114–0.643)
Salary	−0.5645	0.3187	−1.771	0.077	0.57 (0.305–1.062)	
Salary > 10 million won	−0.4491	0.3791	−1.185	0.236	0.63 (0.304–1.342)	
Teaching time per week	−0.0735	0.1819	−0.404	0.686	0.93 (0.650–1.327)	
Job satisfaction						
Work overload	0.8286	0.2560	3.237	0.001	2.29 (1.387–3.782)	2.23 (1.391–3.885)
Uncontrollable workload	0.5259	0.2065	2.546	0.011	1.69 (1.129–2.536)	1.65 (1.066–2.542)
Unsatisfactory rewards	0.4629	0.2146	2.157	0.031	1.59 (1.043–2.419)	0.99 (0.478–2.057)
Interpersonal conflict	0.5253	0.2087	2.516	0.012	1.89 (1.123–2.546)	1.72 (1.130–2.608)
Unfairness	0.7789	0.2281	3.414	< 0.001	2.18 (1.393–3.407)	2.23 (1.415–3.504)
Value mismatch	0.9792	0.2566	3.816	< 0.001	2.66 (1.610–4.402)	2.63 (1.599–4.362)
Lack of personal accomplishment						
Age < 50 yr	−0.2187	0.8196	−0.267	0.790	0.80 (0.161–4.006)	
Marital status, single	−0.6260	0.7294	−0.858	0.391	0.53 (0.128–2.234)	
Living with family	1.5999	0.7055	2.268	0.023	4.95 (1.242–19.739)	5.24 (1.269–21.654)
No. of research sessions per week	−0.4161	0.2776	−1.499	0.134	0.660 (0.382–1.136)	
≥ 3 sessions	−1.2637	0.6703	−1.885	0.059	0.28 (0.076–1.051)	
Salary	0.7496	0.6984	1.073	0.283	2.12 (0.538–8.319)	
Salary > 10 million won	0.8664	0.8131	1.066	0.287	2.38 (0.483–11.705)	
Teaching time per week	−0.6316	0.2726	−2.317	0.021	0.53 (0.312–0.907)	0.53 (0.308–0.909)
Job satisfaction						
Work overload	−0.0895	0.4087	−0.219	0.827	0.91 (0.410–2.037)	
Uncontrollable workload	0.7600	0.3623	2.098	0.036	2.14 (1.051–4.350)	2.36 (1.112–5.007)
Unsatisfactory rewards	−0.0064	0.3709	−0.017	0.986	0.99 (0.480–2.056)	
Interpersonal conflict	0.5250	0.3828	1.371	0.170	1.69 (0.798–3.579)	
Unfairness	0.4638	0.3696	1.255	0.210	11.59 (0.771–3.281)	
Value mismatch	0.8216	0.4104	2.002	0.045	2.27 (1.017–5.084)	2.29 (1.016–5.168)

SE = standard error, OR = odds ratio, CI = confidence interval.

DISCUSSION

Burnout among healthcare professionals, particularly cardiologists, has emerged as a pressing concern, given its adverse effects on patient care and physician's well-being. This study is the first investigation of burnout among healthcare professionals specializing in cardiology, particularly imaging cardiologists, in Korea. The KSE conducted a survey, and owing to the high response rate (72.5%) among all imaging cardiologists, this study can be considered a nationally representative survey analysis of Korean imaging cardiologists.

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Our findings reveal that a significant majority of imaging cardiologists have high workloads. More than half (53.2%) of the imaging cardiologists were required to perform > 5 of 10 sessions weekly, and the vast majority (92.9%) of the respondents worked in > 3 outpatient clinics weekly. Additionally, nearly half (47.7%) were involved in outpatient clinic or echocardiographic laboratory duties on Saturdays, emphasizing the substantial demand extending into weekends. Notably, our study identified age-related trends in burnout prevalence, with a peak in emotional exhaustion and depersonalization observed among individuals aged 46–50 years, followed by a decline in subsequent age groups. While these trends were not significant, they suggested potential age-related factors influencing susceptibility to burnout.

This heavy workload appears to be driven by the structure of tertiary hospitals in Korea, which are typically university hospitals where faculty members are expected to fulfill multiple roles, including patient care, research, student education, clinical practice, and various medical administrative tasks.[21] The responsibility of managing these multiple roles results in significant work overload, and we found that work overload significantly increases the risk of overall burnout, with a 3.5 times higher emotional exhaustion-related burnout risk and 2.2 times higher depersonalization-related burnout risk. These findings are consistent with those of the 2019 European Association of Cardiovascular Imaging survey of imaging cardiologists, where 68% of participants indicated that work overload was a major source of stress.[22] Additionally, the 2023 Cardiologist Lifestyle, Happiness & Burnout Report highlighted excessive bureaucratic tasks (65%) and long working hours (37%) as primary contributors to cardiologist burnout.[23]

The heavy workload identified in this survey is largely due to structural issues, as all tertiary hospitals in Korea also serve as teaching institutions. Imaging cardiologists are required to simultaneously take on the dual roles of attending physician and professor, without the support of physician assistants or specialist registrars in the clinical setting. This dual role exacerbates their workload and contributes significantly to burnout. It is essential to expand the workforce by recruiting more clinicians and reducing their clinical workload to manageable levels.

Age-related differences in the risk of burnout may also be related to one's ability to cope with work overload. In Korean medical schools, reaching around the age of 50 often leads to a stable position as a full-time professor, with more opportunities to teach and mentor rather than the sole focus being on clinics and research responsibilities. Consequently, professors > 50 years tend to experience greater job satisfaction, a greater sense of accomplishment, and a lower risk of emotional exhaustion and depersonalization.

During the coronavirus disease pandemic, a survey conducted among medical school faculty members in Korea reported that 30.5% experienced severe burnout, and 47.7% considered leaving their jobs, with 8% reporting suicidal thoughts and 0.6% having attempted suicide during the pandemic.[15] Additionally, a survey of imaging cardiologists in Europe revealed significantly higher burnout rates among these specialists, reaching 58%, which is a 64% increase in severity compared to pre-pandemic levels.[22] Furthermore, 44% of imaging cardiologists considered leaving their jobs, and 6% reported experiencing suicidal thoughts during the pandemic.[22] Given the high prevalence and severe consequences of burnout, it is crucial to understand the specific factors contributing to burnout in this group.

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The novelty of the current study lies in its identification of both environmental and subjective job satisfaction-related factors that might contribute to burnout among imaging cardiologists. Specifically, unmarried respondents reported a 3.4-fold higher emotional exhaustion-related burnout risk, whereas those living with family reported a 5.24-fold higher risk of experiencing a lack of personal accomplishment. This aligns with findings by Mehta et al.,[24] who reported that individuals experiencing burnout were less likely to be unmarried (79% vs. 85%, $P \leq 0.01$) and more likely to perceive that their work interfered with family responsibilities (46% vs. 29%, $P \leq 0.001$). Additionally, another study indicated that 37% of physicians across various specialties desired reduced working hours to better attend to their children.[25] Our findings suggest that marriage mitigates emotional exhaustion among imaging cardiologists, but the additional responsibilities associated with living with family could contribute to a lack of personal accomplishment in their work.

We also observed that the inability to control workload contributed to a 1.73 times higher risk of emotional exhaustion, while a mismatch between personal values and work increased the risk by 2.19 times. These two factors also increased the risk of depersonalization, with uncontrollable workload contributing to a 1.65 times higher risk and value mismatch, to a 2.63 times higher risk. Furthermore, lack of personal accomplishment was also associated with a higher burnout risk among those experiencing uncontrollable workload with an age-adjusted OR of 2.36 and value mismatch with an age-adjusted OR of 2.29. Across all three burnout dimensions, the significant contributors were not external factors, such as work overload and salary, but subjective factors, including uncontrollable workload and value mismatch. These findings indicate that burnout is heavily influenced by subjective circumstances and perceptions. Hence, while addressing manpower shortages is crucial, it is equally important to evaluate and support individual values and subjective factors to prevent burnout effectively.

The long-term effects of burnout can be profound and far reaching. Persistent burnout is linked to severe mental health issues, including depression, anxiety, and chronic stress.[26] These conditions not only affect physician well-being but also impair cognitive functions, potentially compromising clinical decision-making abilities.[27] Consequently, increasing burnout rates can exacerbate physician turnover, placing a greater burden on the remaining workforce. Issues, such as the inability to control workload and long working hours with a manpower shortage, identified as risk factors in our study, need to be resolved from a long-term perspective.

First, our study relied on self-reported data, which may introduce a response bias owing to under-reporting or over-reporting burnout and associated factors. Second, the cross-sectional design of the survey precludes any causal inferences between the identified factors and burnout risk. Third, the survey was conducted over a short 1-week period, which might have limited the participation rate and comprehensiveness of the responses. Further research using a longitudinal design, broader sampling, and qualitative methods may provide a more comprehensive understanding of burnout and its determinants.

Our study highlights the significant prevalence of burnout among imaging cardiologists in Korea and identifies key contributing factors. The survey responses suggest that effective workload management, work-life balance promotion, and job satisfaction enhancement could be crucial strategies to mitigate burnout and support the well-being of imaging cardiologists. Further research is warranted to explore additional interventions and longitudinal outcomes to address burnout in healthcare providers.

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SUPPLEMENTARY MATERIALS

Supplementary Table 1
Demographic characteristics and working environment

Supplementary Table 2
Demographic characteristics and general information according to age groups

Supplementary Table 3
Working environment according to age groups

Supplementary Fig. 1
Distribution of hospitals where respondents worked.

Supplementary Fig. 2
Histograms of Maslach Burnout Inventory-Human Service Survey scores for emotional exhaustion, depersonalization, and lack of personal accomplishment. Scores are presented as mean and standard deviation.

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