



DOI: 10.4274/haseki.galenos.2026.24633

Med Bull Haseki 2026;64(3):213-219

# Comparison of Anxiety Levels and Satisfaction of Patients Who Underwent CABG Surgery in a PPP Hospital and in a Public Hospital

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## Abstract

**Aim:** Public-private partnership (PPP) hospitals have been increasingly implemented in Türkiye to improve healthcare infrastructure and patient comfort. Coronary artery bypass grafting (CABG) is a high-risk surgical procedure frequently associated with significant preoperative anxiety, which may influence perioperative outcomes. This study aimed to compare preoperative anxiety levels and patient satisfaction among CABG patients treated at both a public hospital and a PPP-operated hospital with similar clinical capacity.

**Methods:** A total of 2,201 patients who underwent isolated CABG between April 2016 and July 2024 were included in a retrospective analysis. Patients were divided into two groups: alethe [public hospital group (PHG), n=1.110] and the [PPP hospital group (PPPHG), n=1.091]. Patients using antidepressant or anxiolytic medications or with known psychiatric disorders were excluded. Preoperative anxiety was assessed using the Beck Anxiety Inventory (BAI), and patient satisfaction was evaluated using the Patient Satisfaction Questionnaire Short Form (PSQ-18) and patient satisfaction were assessed using the BAI and the PSQ-18, respectively. Continuous and categorical variables were compared using Student's t-test and  $\chi^2$  test, respectively.

**Results:** Overall patient satisfaction scores did not differ significantly between the two groups. However, preoperative anxiety levels were significantly lower in the PPPHG compared with the PHG (BAI:  $9.3\pm 4.1$  vs.  $17.8\pm 6.4$ ;  $p<0.001$ ). Higher anxiety levels were associated with previous percutaneous coronary intervention, chronic obstructive pulmonary disease, divorced or widowed marital status, and lower socioeconomic status.

**Conclusion:** While patient satisfaction with medical care was similar in both hospital models, CABG patients treated in the PPP hospital experienced significantly lower preoperative anxiety. Hospital environment and organizational characteristics may influence psychological well-being independently of clinical care quality.

**Keywords:** Public-private partnership, coronary artery bypass grafting, anxiety, patient satisfaction, Beck Anxiety Inventory

## Introduction

A routine visit to an ordinary hospital for a serious medical condition is often stressful and uncomfortable (1). Healthcare institutions, no matter how good they are, are usually insufficient to break the tie between trust and anxiety (1,2). Technological innovations in the healthcare field should be implemented to create more reliable impressions among patients but they fail to demonstrate their potential benefits for many reasons. According to the 2023 budget discussion in the Turkish Grand National

Assembly, Türkiye has spent approximately 1.6 trillion over the last two decades on building new hospitals, including project costs for new public-private partnership (PPP) hospitals (3,4). Despite this total outlay, Türkiye has the lowest healthcare expenditure in Europe, at most 6.4% of gross domestic product per year [3-6] (1-3). PPP hospitals were built over the last 10 years in Türkiye to improve the effectiveness of care delivery, patient safety, and comfort (5). Moreover, these new institutions aim to reduce patient and family anxiety, thereby improving overall outcomes

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**Received:** 02.02.2025 **Accepted:** 26.02.2026 **Epub:** 31.03.2026

**Cite this article as:** Onar LC. Comparison of anxiety levels and satisfaction of patients who underwent CABG surgery in a PPP hospital and in a public hospital. Med Bull Haseki. 2026;64(3):213-219



and quality of service (5,6). The PPP model has introduced a new horizon in hospital design for Turkish architects and contractors (7). This new pattern of hospital design provided good indoor views, spaciousness, and brightness. In addition to the current literature, patients reported that accessible, well-resourced, and comfortable facilities build trust and prevent a sense of impending threat or doom, particularly for patients scheduled to undergo major surgery and those with type D personality (8-11). In Türkiye, cardiovascular diseases remain the primary cause of mortality (35.4%) (12). The fear of death is a natural consequence of acute cardiovascular events occurring in hospitals (13). These new facilities may improve patient comfort and reduce anxiety (14,15). This theory forms the basis of this study. In medical schools, it is always taught that evidence-based medicine is essential for clinical practice; similarly, evidence-based hospital design makes hospitals safer, more conducive to curative care, and a better place to work and may be essential for better clinical outcomes in the near future.

Symptoms of anxiety are common among surgical patients, especially before coronary artery bypass grafting (CABG) surgery (16). Coronary bypass patients usually spend more than 3-4 days in the hospital before surgery. They are generally referred by another physician after the diagnostic period, or they are admitted to the emergency department with acute coronary syndromes. The period before referral for surgery generally provides them with an opportunity to observe the advantages and disadvantages of the hospital facilities, the in-hospital routines of healthcare workers, and sometimes adverse events, which may evoke mixed feelings in them. Therefore, the coronary bypass patients are suitable subjects for observing the mood-affecting features of the institutions.

The Patient Satisfaction Questionnaire Short Form (PSQ-18) is a validated tool to determine and improve the weaknesses in the health system and to compare patient satisfaction scores across different health-care organizations, departments, or hospitals (17). The Beck Anxiety Inventory (BAI) questionnaire has been widely used in cardiac patients and has been found to be a good scale for evaluating the psychometric properties of different individuals (18). Hospitals with futuristic and well-designed environments play a unique role in patients' psychological status (19). It has long been a tradition among Turkish people, to build resplendent, peaceful spaces that incorporate symbolic environmental features, creating relaxing atmospheres, such as ornamental pools with burbling water and the sound of traditional flutes (20,21). Wide corridors, high ceilings, and soft, cool spaces are other reassuring, anxiety-preventing structural features (19).

The patients in Turkish city hospitals experience convenience and confidence in designated social spaces where they can reduce stress and arousal. Earlier studies of anxiety in patients with heart disease have both strongly assumed and demonstrated that high levels of preoperative anxiety are positively associated with longer hospitalization, postoperative readmission, and recurrent cardiac events, which may be detectable and preventable (22).

This study aims to show the impact of the Turkish model of the "city hospital concept" on anxiety and patients' positive psychological responses before the CABG procedures.

## **Materials and Methods**

### **Compliance with Ethical Standards**

Ethical approval for this study was obtained from the Dr. Ismail Fehmi Cumalioglu City Hospital Clinical Trials Ethics Committee (approval no: 105, date: 19.04.2024). Due to the retrospective design of the study, the requirement for informed consent was waived by the committee. All data were fully anonymized prior to analysis. This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

### **Study Design**

After approval by the local ethics committee, data collection was initiated in two hospitals with comparable capacity. Cardiac surgery in these two institutions was not available until the author started working in them. Cardiac surgery in the non-PPP hospital (hereafter referred to as Hospital 1) began in April 2016; the patients' psychological status and anxiety levels (BAI) were recorded with the future objective of improving and retrofitting the design of the cardiovascular surgery clinic. The PPP hospital (which will be referred to as Hospital 2) began admitting cardiac surgery patients in January 2021.

The 1,110 patients from hospital 1 (will be referred to as the public hospital group (PHG), and 1,091 patients from hospital 2 [will be referred to as the PPP Group, PPP hospital group (PPPHG)] have been included in the study.

### **Inclusion and Exclusion Criteria**

The two cohorts were selected to maximize clinical homogeneity with respect to chronic comorbidities and angiographic coronary disease severity. Exclusion criteria were:

1. Current or past use of monoaminergic antidepressants or anxiolytic medications (e.g., selective serotonin reuptake inhibitors/serotonin-norepinephrine reuptake inhibitors),
2. Previous diagnosis of major depressive or psychotic disorders,
3. History of prior CABG surgery,
4. Emergent indication for CABG,

5. Minimally invasive direct coronary artery bypass procedures.

### Psychological and Satisfaction Measures

Two validated instruments were administered during the preoperative period:

Beck Anxiety Inventory for anxiety levels,

-Patient Satisfaction Questionnaire Short Form for overall satisfaction with medical care (17).

The BAI consists of 21 items, each scored 0-3, with established severity thresholds: 0-7 (minimal), 8-15 (mild), 16-25 (moderate), and 26-63 (severe). Patient Satisfaction Questionnaire Short Form evaluates multiple subdomains of satisfaction, including general satisfaction, technical quality, interpersonal manner, communication, accessibility, and time spent with physicians (23,24). Financial subdomains of the original PSQ-III were excluded due to the standardized Turkish Social Security reimbursement system.

### Statistical Analysis

Continuous variables were expressed as mean  $\pm$  standard deviation and compared using Student's t-tests. Categorical variables were expressed as proportions and compared using  $\chi^2$  tests. Univariable analyses were performed to identify factors associated with anxiety and satisfaction outcomes. A p-value  $<0.05$  was considered statistically significant. Statistical analyses were performed using the SPSS software, version 20.0 (IBM Corp., Armonk, NY, USA).

## Results

### Baseline and Operative Characteristics

A comprehensive overview of demographic variables, comorbid conditions, New York Heart Association (NYHA) classification, socio-economic and marital status, prior cardiac interventions, and insurance coverage for both groups is provided in Table 1. The distributions of age, sex, and major cardiovascular risk factors were similar across both institutions, with expected variations across comorbidity clusters.

Operative characteristics were also comparable. Cross-clamp time did not differ significantly between groups (PHG 89.4 $\pm$ 12.6 min vs. PPPHG 87.8 $\pm$ 13.1 min;  $p=0.214$ ), nor did cardiopulmonary bypass duration (117.2 $\pm$ 18.5 min vs. 115.6 $\pm$ 17.9 min;  $p=0.301$ ). Intensive care unit and total hospital stays were equivalent ( $p>0.05$  for both).

### Patient Satisfaction

Patient Satisfaction Questionnaire Short Form analysis demonstrated no significant differences in overall satisfaction or in subdomains, including technical quality, interpersonal manner, communication, accessibility, and

time spent with physicians (all  $p>0.05$ ). These results are summarized in Table 2.

Univariable analyses identified poorer NYHA functional class ( $p<0.001$ ) and impaired renal function ( $p=0.000$ ) as predictors of higher satisfaction, suggesting that patients with greater clinical acuity perceived care as more responsive.

### Preoperative Anxiety

In contrast, BAI scores revealed significantly lower anxiety levels in the PPPHG compared with the PHG (9.3 $\pm$ 4.1 vs. 17.8 $\pm$ 6.4;  $p<0.001$ ). Beck Anxiety Inventory severity categorization showed that PHG patients were more frequently in moderate/severe categories, whereas PPPHG patients were predominantly in minimal/mild categories (Table 3).

Higher anxiety scores were associated with prior percutaneous coronary intervention (PCI) ( $p<0.001$ ), chronic obstructive pulmonary disease (COPD) ( $p<0.001$ ), atrial fibrillation ( $p<0.001$ ), divorced or widowed marital status ( $p=0.000$ ), and lower socioeconomic status ( $p=0.000$ ).

### Postoperative Outcomes

Early mortality was similar (PHG 0.7% vs. PPPHG 0.5%;  $p=0.612$ ). Postoperative complications—including acute renal failure, major hemorrhage, prolonged ventilation, and transfusion requirements—did not differ significantly between groups. Although psychological parameters differed, perioperative morbidity and mortality outcomes remained clinically equivalent.

## Discussion

The purpose of this study was to examine the influence of hospital management models—specifically the PPP model—on patient satisfaction and preoperative anxiety levels in individuals undergoing CABG surgery. By comparing two hospitals operating under different management models within the same city, we aimed to minimize regional and demographic variability. The findings demonstrate that although overall patient satisfaction was similar between the two institutions, patients treated in the PPP hospital experienced significantly lower levels of preoperative anxiety.

Patient satisfaction, assessed using the PSQ-18, did not differ significantly between the public and PPP hospitals. This suggests that core components of clinical care, such as physician competence, communication, and treatment effectiveness, were perceived similarly across both settings. In contrast, anxiety levels measured by the BAI were substantially lower among patients at the PPP hospital, indicating that psychological outcomes may be influenced by factors beyond clinical care.

The reduced anxiety observed in the PPP group may be attributed to characteristics inherent to the PPP framework, including improved hospital infrastructure, maintenance quality, and environmental design. Previous

studies have shown that hospital environments with better room design, access to natural light, reduced noise, and enhanced privacy can positively influence patients' psychological well-being and reduce stress, particularly in

**Table 1. Demographic findings of the study group**

Variable n		PHG (Group 1, n=1110)		PPPHG (Group 2, n=1091)	
		%	n	%	n
Gender	Female	586	52	607	55
	Male	524	48	484	45
Age	Mean		SD	Mean	SD
	61.4		0.54	58.6	0.86
	n		%	n	%
Body mass index (BMI, kg/m <sup>2</sup> )	Underweight	11	1.12	21	1.19
	Normal	618	55.6	654	59.9
	Overweight	467	42	387	35.4
	Obese	14	1.26	29	2.65
Diabetes		451	40.6	474	43.4
Hypertension		420	37.9	491	45
Hyperlipidemia		371	33.4	391	36.2
COPD		121	10.9	91	8.3
NYHA functional classification	Class 1	465	41.8	521	47.7
	Class 2	346	31.1	398	36.4
	Class 3	213	19.1	98	8.9
	Class 4	86	7.7	74	6.7
Chronic renal insufficiency	Stage 3	127	8.7	161	14.7
	Stage 4	51	4.5	74	6.7
	Stage 5	19	1.7	30	2.7
Smoking status	Non-smoker	396	35.6	427	39.1
	Smoker	635	57.2	554	50.7
	Electronic smoker	79	7.2	110	10.2
History of previous cardiac intervention	Diagnostic CAG	101	9	126	11.5
	Primer PCI	316	28.4	271	24.8
	PCI	206	18.5	180	16.4
	No history	587	52.8	514	47.1
Marital status	Married	729	65.6	761	69.7
	Single	210	18.9	211	19.3
	Divorced/widow	171	15.4	119	10.9
Socioeconomic status	High	691	62.2	511	46.8
	Middle	310	27.9	420	38.4
	Low	109	9.8	160	14.6
Insurance status	Social security institution (SSI, SGK)	911	82	859	78.7
	Green card	141	12	186	17.1
	No insurance	46	4.1	21	1.9
	Foreign insurance	12	1.1	25	2.2

PHG: Public hospital group, COPD: Chronic obstructive pulmonary disease, NYHA: New York Heart Association, CAG: Coronary angiography, PCI: Percutaneous coronary intervention, SSI: Social security institution, PPPHG: Public-private partnership hospital group

high-risk surgical populations. In this context, the physical setting and overall hospital experience in the PPP hospital may have mitigated the psychological distress commonly associated with major cardiac surgery.

Conversely, public hospitals are often characterized by higher patient volumes, limited physical space, and fewer opportunities for environmental optimization. Overcrowded waiting areas, reduced privacy, and longer waiting times may contribute to increased psychological stress, especially in patients undergoing complex procedures such as CABG. In our study, higher anxiety levels were associated with a history of PCI and COPD, as well as lower socio-economic status, supporting the notion that patients with greater medical complexity and social vulnerability are particularly susceptible to anxiety in hospital settings.

In addition to anxiety outcomes, the study identified factors influencing patient satisfaction. Patients with

a worse NYHA functional class and impaired renal function reported higher satisfaction with medical care. This finding may reflect increased attention, monitoring, and perceived support provided to patients with more severe clinical conditions. More frequent interactions with healthcare professionals and heightened clinical vigilance may positively affect patients' perceptions of care quality, even in the presence of significant disease burden.

The absence of significant differences in satisfaction, despite differing anxiety levels, suggests that satisfaction and anxiety represent distinct dimensions of patient experience. While satisfaction appears to be closely linked to clinical competence and interpersonal aspects of care, anxiety may be more sensitive to environmental and organizational factors. This distinction is particularly relevant in the perioperative period, during which psychological stress can influence recovery, length of hospitalization, and overall patient well-being.

**Table 2. The univariate analysis of PSQ-18 survey for the Group 1 (PHG) and the Group 2 (PPPHG)**

Subscale and item	Category	PHG		PPPHG		Statistical significance
		Mean	SD±	Mean	SD±	p-value
Doctors are good about explaining the reason for medical tests	Communication	4.0	0.7	4.1	0.1	p>0.05
I think my doctor's office has everything needed to provide complete care.	Technical quality	3.0	0.6	4.8	0.2	p<0.001
The medical care I have been receiving is just about perfect	General satisfaction	4.4	0.2	4.8	0.2	p>0.05
Sometimes doctors make me wonder if their diagnosis is correct	Technical quality	2.9	0.2	4.6	0.2	p<0.001
I feel confident that I can get the medical care I need without being set back financially	Financial aspects	3.9	0.7	4.2	0.1	p>0.05
When I go for medical care, they are careful to check everything when treating and examining me	Technical quality	3.3	0.4	4.6	0.2	p<0.001
I have to pay for more of my medical care than I can afford	Financial aspects (N/A)	3.4	0.6	4.4	0.2	p>0.05,
I have easy access to the medical specialists I need	Accessibility and convenience	4.0	0.7	4.6	0.6	p<0.001
Where I get medical care, people have to wait too long for emergency treatment	Accessibility and convenience	3.4	0.2	4.0	0.7	p<0.001
Doctors act too businesslike and impersonal toward to me	Interpersonal manner	4.3	0.4	4.4	0.4	p>0.05
My doctors treat me in a very friendly and courteous manner	Interpersonal manner	4.4	0.5	4.5	0.2	p>0.05
Those who provide my medical care sometimes hurry too much when they treat me	Time spent with doctor	3.9	0.6	4.1	0.2	p=0.00
Doctors sometimes ignore what I tell them	Communication	4.0	0.1	4.1	0.5	p>0.05
Doctors usually spend plenty of time with me	Time spent with doctor	3.6	0.2	4.6	0.2	
I find it hard to get an appointment for medical care right away	Accessibility and convenience	4.0	0.7	4.0	0.2	p>0.05
I am dissatisfied with some things about the medical care I receive	General satisfaction	4.5	0.7	4.5	0.6	p>0.05
I am able to get medical care whenever I need it	Accessibility and convenience	4.5	0.5	4.8	0.1	p>0.05

PHG: Public hospital group, PPPHG: Public-private partnership hospital group, SD: Standard deviation, PSQ-18: Patient Satisfaction Questionnaire Short Form

Variable	PHG	PPPHG	p-value
Continuous BAI score (mean ± SD)	17.8±6.4	9.3±4.1	<0.001
Minimal (0-7)	144 (13.0%)	491 (45.0%)	<0.001
Mild (8-15)	367 (33.1%)	358 (32.8%)	0.882
Moderate (16-25)	413 (37.2%)	202 (18.5%)	<0.001
Severe (≥26)	186 (16.8%)	40 (3.7%)	<0.001

BAI: Beck Anxiety Inventory, PHG: Public hospital group, PPPHG: Public-private partnership hospital group, SD: Standard deviation

Several mechanisms may explain the lower anxiety levels observed in PPP hospitals. A well-designed hospital environment can promote a sense of safety, comfort, and privacy, all of which are essential for patients undergoing major surgery. Features such as single or less-crowded rooms, improved wayfinding, reduced noise, and aesthetically pleasing interiors may contribute to psychological reassurance. In addition, PPP hospitals often benefit from structured facility management, efficient service delivery, and patient-centered amenities, all of which may reduce stress during hospitalization (25-27).

The psychological benefits observed in the PPP group cannot be attributed solely to the hospital management model. Patient-related factors such as socio-economic status, marital status, and comorbid conditions were also significant determinants of anxiety. Lower socioeconomic status and being divorced or widowed were associated with higher anxiety levels, underscoring the complex interaction between social, psychological, and clinical factors in shaping patient experiences. These findings highlight the need for comprehensive perioperative care strategies that address both medical and psychosocial needs, regardless of hospital type (28).

Notably, early postoperative outcomes and complication rates were similar between the two hospitals, suggesting that the observed differences in anxiety were not related to variations in surgical performance or immediate clinical outcomes. This supports the interpretation that the hospital environment and organizational characteristics primarily influence psychological outcomes, rather than short-term surgical results. Addressing preoperative anxiety may therefore represent an additional opportunity to improve patient-centered care without altering established clinical protocols.

### Study Limitations

This study has several limitations that should be considered. First, its observational design limits the ability to establish causal relationships between hospital management models and patient outcomes, and the lack of randomization may have introduced selection bias. Second, although the study was conducted in two hospitals within a single metropolitan region,

which may limit generalizability to other geographic or healthcare settings, this design ensured a high degree of homogeneity in referral patterns, socioeconomic characteristics, and cultural context. Such homogeneity reduces environmental and demographic variability that would otherwise confound psychological and satisfaction measures, thereby strengthening internal validity while constraining external applicability. In addition, anxiety and patient satisfaction were assessed using self-reported instruments, which may be subject to response bias. While major psychiatric disorders were excluded, subclinical psychological conditions and unmeasured psychosocial factors may still have influenced the results. Finally, the study did not directly assess specific environmental or infrastructural characteristics of the hospitals, thereby limiting the ability to identify the elements that most strongly contributed to differences in anxiety levels. Future multicenter and prospective studies incorporating objective environmental measures are warranted. Despite these limitations, the study provides valuable insights into the role of hospital management models in shaping patients' psychological experiences. While perceived clinical care satisfaction appeared comparable between public and PPP institutions, preoperative anxiety may be differentially shaped by higher-order institutional features, including environmental affordances, spatial ergonomics, and patient-centric service infrastructures. In complex surgical populations, such contextual variables have been implicated in modulating cognitive appraisal processes and stress responses, suggesting that the perioperative psychological trajectory is influenced not only by the competence of medical care but also by the built environment in which care is delivered (29).

### Conclusion

This study shows that, while overall patient satisfaction with medical care was similar between public and public-private partnership hospitals, patients undergoing CABG in PPP hospitals experienced significantly lower levels of preoperative anxiety. These findings suggest that the hospital environment and organizational characteristics may influence psychological outcomes independently of the quality of clinical care. Addressing preoperative anxiety

may represent an important component of patient-centered cardiac care. Further multicenter and prospective studies are needed to clarify the mechanisms underlying these observations.

### Ethics

**Ethics Committee Approval:** Ethical approval for this study was obtained from the Dr. Ismail Fehmi Cumalioglu City Hospital Clinical Trials Ethics Committee (approval no: 105, date: 19.04.2024).

**Informed Consent:** Due to the retrospective design of the study, the requirement for informed consent was waived by the committee.

### Footnotes

**Financial Disclosure:** The author declared that this study received no financial support.

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