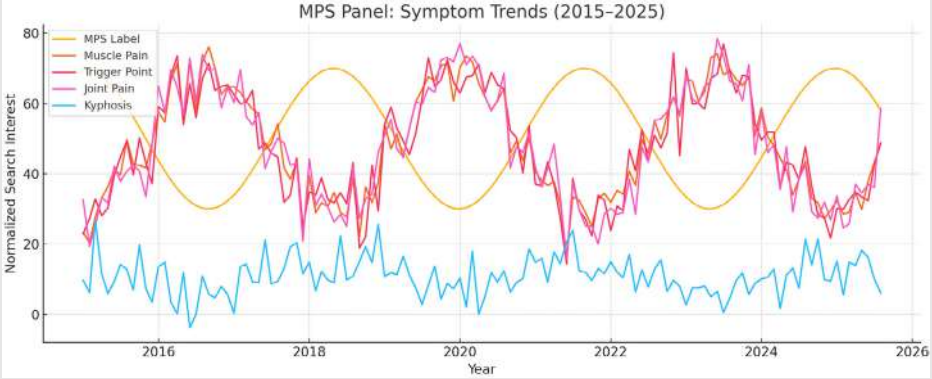
ISSN 2651-3153 • EISSN 2651-3153

European Archives of Medical Research

Formerly Okmeydanı Medical Journal

Volume: 41 • Number: 4 • December 2025



See Page 211

Highlights

- Dependency, Well-being on Life Satisfaction
  Ozge Iseri, Hasan Saritas
- YouTube Pes Planus Video Quality
  Cem Sever, Enver Ipek
- Symptom Keywords for Fibromyalgia and Myofascial Pain Syndrome
  Gokhan Ozkocak
- Adalimumab Search Trends in Türkiye
  Berru Yargi Ozkocak, Gokhan Ozkocak
- Vertical Incision Enhances Midvastus Outcomes
  Serhat Gurbuz, Hakan Bahar
- Stress Levels of Assistants
  Abdurrahman Tunay, Sevim Baltali, Gul Cakmak, Ozlem Atesal, Meryem Ozyolcu
- Obesity, Radial Bowing in Radius Fractures
  Hakan Sesen, Ugur Kadir Kartal
- Long-Term Outcomes of ACL Reconstruction
  Ugur Temel, Sule Karadayi
- Pre-Operative Cardiac Risk Assessment in Elderly
  Berna Caliskan, Goksu Guldal, Bengisu Seker, Simge Turk, Beste Aydin, Zeki Besir

KARE MEDYA

Official Journal of University of Health Sciences Türkiye, Prof. Dr. Cemil Taşcıoğlu City Hospital
eurarchmedres.org

European Archives of Medical Research

Formerly Okmeydanı Medical Journal

European Archives of Medical Research

Formerly Okmeydanı Medical Journal

Publisher Contact

	Prof. Dr. Cemil Taşcıoğlu City Hospital
Address	*University of Health Sciences Türkiye, Prof. Dr. Cemil Taşcıoğlu City Hospital Clinical of E.N.T. / Okmeydani / Istanbul*
E-mail	*info@okmeydanitipdergisi.org*
Website	*cemiltascioglush.saglik.gov.tr*

Publishing House

Kare Publishing

Address	*Göztepe Mah. Fahrettin Kerim Gökay Caddesi No: 200/A D:2 Çemenzar - Kadıköy, İstanbul-Türkiye*
Phone	*+90 216 550 61 11*
Fax	*+90 216 550 61 12*
Web	*www.karepb.com*
E-mail	*kare@karepb.com*

**For requests concerning advertising on printed versions and on the webpage of European Archives of Medical Research, please contact the publisher KARE Publishing.*

European Archives of Medical Research

Formerly Okmeydanı Medical Journal

Please refer to the journal's webpage **(https://eurarchmedres.org/)** for "Aims and Scope", "Instructions to Authors" and "Ethical Policy".

The editorial and publication process of the European Archives of Medical Research are shaped in accordance with the guidelines of ICMJE, WAME, CSE, COPE, EASE, and NISO. The journal is in conformity with the Principles of Transparency and Best Practice in Scholarly Publishing.

European Archives of Medical Research is currently indexed in **TUBITAK ULAKBIM TR Index, Gale, ProQuest, Türk Medline, Türkiye Atıf Dizini, J-GATE** and **EBSCO Host**.

The journal is published online.

Owner: Ali ALEMDAR on Behalf of İstanbul Prof. Dr. Cemil Taşcıoğlu City Hospital

Responsible Manager: İsmail DEMİRKALE

European Archives of Medical Research

Formerly Okmeydanı Medical Journal

CONTENTS

ORIGINAL ARTICLES

193 **The Impact of Care Dependency, Spiritual Well-Being, and Selected Variables on Satisfaction with Life in Recipients of Liver Transplantation**
Ozge Iseri, Hasan Saritas; Samsun, Türkiye

201 **Assessing the Quality and Reliability of Pes Planus Videos on Youtube: Implications for Health Information and Patient Education**
Cem Sever, Enver Ipek; Doha, Qatar

209 **Mapping Patient-Facing Symptom Keywords for Fibromyalgia and Myofascial Pain Syndrome Using Google Trends: Implications for Clinic Communication in Türkiye (2015–2025)**
Gokhan Ozkocak; Istanbul, Türkiye

214 **Analysis of Online Information-Seeking Behaviors Related To Adalimumab in Türkiye Using Google Trends Data (2016–2025)**
Berru Yargi Ozkocak, Gokhan Ozkocak; Istanbul, Türkiye

222 **Vertical Midvastus Incision Enhances Early Recovery in Total Knee Arthroplasty**
Serhat Gurbuz, Hakan Bahar; Istanbul, Türkiye

229 **Stress, Anxiety, and Work-Related Distress Among Medical Residents: A Comparative Analysis of Anesthesiology and Internal Medicine Residents**
Abdurrahman Tunay, Sevim Baltali, Gul Cakmak, Ozlem Atesal, Meryem Ozyolcu; Istanbul, Türkiye

235 **Radial Bowing and Obesity: Do They Increase The Need For Surgical Intervention in Pediatric Radial Epiphyseal Fractures?**
Hakan Sesen, Ugur Kadir Kartal; Ankara, Türkiye

241 **Prognostic Indicators in Pleural Effusion: A Retrospective Study**
Ugur Temel, Sule Karadayi; İstanbul, Türkiye

246 **Pre-Operative Cardiac Risk Assessment to Predict Mortality and Intensive Care Admission in Elderly Patients Scheduled for Non-Cardiac Surgery: Comparison of The Revised Cardiac and Geriatric Sensitive Cardiac Risk Indices With Cardiology-Determined Risk**
Berna Caliskan, Goksu Guldal, Bengisu Seker, Simge Turk, Beste Aydin, Zeki Besir; İstanbul, Türkiye

253 **REVIEWER LIST (2025)**

ORIGINAL ARTICLE

European Archives of Medical Research

DOI: 10.14744/eamr.2025.34735
Eur Arch Med Res 2025;41(4):193–200

The Impact of Care Dependency, Spiritual Well-Being, and Selected Variables on Satisfaction with Life in Recipients of Liver Transplantation

Ozge Iseri,[1] Hasan Saritas[2]

[1]Department of Nursing, Ondokuz Mayıs University Faculty of Health Sciences, Samsun, Türkiye
[2]Department of Nursing, Siirt University Faculty of Health Sciences, Siirt, Türkiye

ABSTRACT

Objective: Although care dependency, spiritual well-being, and life satisfaction are important variables, they have not been sufficiently clarified after liver transplantation. The aim was to investigate the impact of care dependency, spiritual well-being, and selected characteristics on the satisfaction of life of liver transplant recipients.

Materials and Methods: A cross-sectional and descriptive study was conducted between May and December 2021 (n=214). Descriptive Characteristics Form, Care Dependency Scale (CDS), Spiritual Well-Being Scale (SWBS), and Contentment with Life Scale (CLAS) were utilized. Descriptive statistics, correlation analysis, and hierarchical linear regression analysis were employed.

Results: The mean scores were found to be 80.10±6.68 for CDS, 40.85±3.46 for SWBS, and 10.78±3.43 for CLAS. A moderate, positive, and significant relationship was identified between CDS and CLAS ($r=0.604$, $p<0.01$), while a low, positive, and significant relationship was observed between SWBS and CLAS ($r=0.271$, $p<0.01$). Gender, health insurance, and the presence of chronic illness were identified as other factors influencing satisfaction with life, explaining 11% of contentment with life variance. Along with these variables, spiritual well-being explained 15% of contentment with life satisfaction, and care dependency explained 37% of life satisfaction.

Conclusion: The care dependency, gender, health insurance, presence of chronic illness and spiritual well-being of liver transplant recipients significantly influence their life satisfaction. It is important to plan nursing interventions considering these variables after surgery and to provide care in a holistic and personalized manner.

Keywords: Care dependency, Life satisfaction, Liver transplants, Nursing, Spirituality, Well-being

Cite this article as: Iseri O, Saritas H. The Impact of Care Dependency, Spiritual Well-Being, and Selected Variables on Satisfaction with Life in Recipients of Liver Transplantation. Eur Arch Med Res 2025;41(4):193–200.

INTRODUCTION

Liver transplantation (LT) is a significant treatment method that enables patients with end-stage liver failure to survive.[1] However, due to being a major surgical intervention, it constitutes a trauma to the human body. This is because such procedures impact the entire body, leading to stress responses, susceptibility to infection, pain, the necessity to adapt to multiple medication regimens to prevent organ re-

Address for correspondence: Ozge Iseri. Department of Nursing, Ondokuz Mayıs University Faculty of Health Sciences, Samsun, Türkiye
E-mail: ozgepekiniseri@gmail.com **ORCID ID:** 0000-0002-6623-8973

Submitted: 07.04.2025 **Revised:** 01.08.2025 **Accepted:** 12.08.2025 **Available Online:** 20.10.2025

European Archives of Medical Research – Available online at www.eurarchmedres.org

jection, anxiety, depression, restrictions in daily life activities, role and economic losses, and consequently an increase in care dependency.[2-4]

Care dependency is the process of relying on and being supported by others to meet one's needs due to a decrease in the individual's self-care ability.[5] Chronic illnesses, aging, surgical interventions, and hospitalization contribute to an increase in care dependency.[6] Liver transplant recipients, facing significant life experiences after LT, also experience an increase in care dependency for these reasons. Studies indicate that patients who undergo surgery are more dependent compared to non-surgical patients, and the recipients have a moderate level of dependency.[7,8] The recovery process for patients involves not only providing adequate medical treatment but also patient-centered nursing care.[9] Reduction of dependency and support for independence contribute to individuals returning to active life, improving their quality of life, and increasing life satisfaction.[3,9] At this point, surgical nurses who provide 24-h uninterrupted care are at a key point.

Liver transplant recipients experience a stressful process throughout all stages of the transplant surgery.[10] Each individual's coping mechanism for this stressful process varies. While some individuals may have more negative attitudes, others may adapt more quickly.[10] At this point, the importance of spiritual well-being in managing and effectively coping with the disease process is emphasized.[11,12] Spiritual well-being is defined as an individual's ability to find meaning in life and have a sense of purpose within life.[13] The spiritual well-being as an indicator of individuals' quality of life in the spiritual domain.[14] Studies have indicated that spiritual beliefs and well-being reduce problems, such as pain, depression, and anxiety and are crucial for a quick and effective recovery from illnesses.[15,16] Given that LT is a major surgical intervention, recipients often experience pain, anxiety, and depression, and feelings of guilt due to the possibility of causing harm to the donor.[17] These factors can significantly impact recipients' adjustment, coping, and life satisfaction during the post-operative period. Furthermore, this increases the likelihood of recipients developing post-transplant complications. Therefore, nurses may need to assess and support recipients' spiritual well-being to achieve positive patient outcomes.

Satisfaction is the feeling and thought that individuals form based on the level of fulfillment of their expectations, needs, and desires, and also an important variable for feeling happy and peaceful life.[18] Life satisfaction, on the other hand, is related to the individual's efforts to achieve all life goals, the extent to which they have achieved them, and how they evaluate and perceive this process.[19] Therefore, life satisfaction is closely connected to good physical and mental health. Studies have shown that life satisfaction varies with age, gender, employment status, education level, economic and marital status, family and social life, and personality traits.[20,21] Studies conducted with different samples have indicated a relationship between spiritual well-being and life satisfaction.[20-22] However, in the literature, no study addressing the relationship between spiritual well-being and life satisfaction in liver transplant recipients has been found. Furthermore, the literature lacks a study investigating the effect of care dependency and spiritual well-being on life satisfaction in liver transplant recipients. The absence of research on these three variables creates a significant gap in the literature, and elucidating these variables is crucial for supporting and delivering high-quality and holistic post-operative care to recipients. Hence, the study aimed to determine the effect of care dependency, spiritual well-being, and selected factors on life satisfaction in recipients. It is believed that the results of the study will provide guidance to organ transplant clinical nurses.

Research Questions

1. Which sociodemographic and clinical characteristics affect satisfaction with life in liver transplant recipients?
2. Does care dependency affect life satisfaction in liver transplant recipients?
3. Does spiritual well-being affect satisfaction with life in liver transplant recipients?
4. What is the relationship between care dependency, spiritual well-being, and life satisfaction in liver transplant recipients?

MATERIALS AND METHODS

Type of the Research

This cross-sectional and descriptive study was aimed to investigate the impact of care dependency, spiritual well-being, and selected characteristics on satisfaction with life of liver transplant recipients. The study followed the EQUATOR guidelines for research reporting by employing the TREND checklist.

Population and Sample

The study was conducted in the organ transplant service and outpatient clinic of a liver transplant institute located in Türkiye, between May 7, 2021, and December 30, 2021. Inclusion criteria for the sample were being 18 years and older, being in the post-operative period, undergoing living donor LT, being hospitalized for at least three days, having the ability to understand and speak Turkish, having person-place-time orientation, and not having hearing or speech problems. Exclusion criteria were multiple organ transplants, cadaveric LT, experiencing liver graft rejection, and undergoing retransplanta-

tion. At the end of the research, using G*power 3.1, with effect size=0.50, p=0.05, and a sample size of 200, the "post hoc" "compute achieved power" analysis indicated a study power of 0.99. For the variable of care dependency, a correlation coefficient of r=0.20 was adopted.[23] Based on this value, with a 95% confidence interval, a 5% margin of error, and 80% power, the sample size was determined to be 193. To account for potential losses, the study was concluded with a total of 214 participants, including approximately 11% backup (21 individuals).

Data Collection

The convenience sampling method was used in the study. The data were collected through face-to-face interviews with voluntary liver transplant recipients who met the research criteria by the authors. The data were collected in a quiet room in the Organ Transplant Service and Outpatient Clinic, with only the researcher and the patient present. During data collection, care was taken to ensure the patient was free from pain and that their vital signs were stable. The average duration for data collection in the study was 20–30 min. After explaining the purpose and outcomes of the research verbal and written consent was obtained from patients. The Descriptive Characteristics Form, the Care Dependency Scale (CDS), the Spiritual Well-Being Scale (SWBS), and the Contentment With Life Scale (CLAS) were used to collect data.

Descriptive Characteristics Form

The form includes a total of 12 questions related to the patient's age, gender, marital status, education and employment status, place of residence, economic status, presence of social security, chronic illness status, time and reason for LT, and the existence of someone who can assist with care.[2-5,8]

The CDS

Originally created by Dijkstra et al.[24] in 1996 and later translated into Turkish by Yönt et al.,[25] the scale comprises 17 items assessed on a five-point Likert scale, with responses ranging from "1=completely dependent" to "5=immediately, almost/completely independent." The total scores on the scale can vary from 17 (minimum) to 85 (maximum), where higher scores signify a higher level of independence in addressing the patient's care requirements.[24,25] There is no cut-off point on the scale. The Cronbach's alpha coefficient for the scale is 0.91,[25] and for this specific study, it is calculated as 0.92.

SWBS

In the context of Türkiye, Aktürk et al.[26] conducted a study to validate and assess the reliability of Peterman's scale.[27] The scale, comprising 12 questions, is structured around three subscales: Faith, peace, and meaning. It is noteworthy that reverse scoring is applied to items 4 and 8. Utilizing a Likert-style structure, the FACIT-Sp scale requires participants to provide responses on a scale ranging from 0 to 4, where "0" represents "never," and "4" corresponds to "always." The overall score on the scale can range from 0 to 48.[26,27] There is no cut-off point on the scale. The scale demonstrates a Cronbach's alpha ranging between 0.78 and 0.93,[27] in this particular study, the calculated value was 0.79.

CLAS

Akın and Yalnız conducted a validation and reliability examination of the scale developed by Lavallee et al.[28] within a Turkish context.[28,29] Consisting of 5 questions, participants respond on a 7-point Likert-style rating scale, with options ranging from "1" (strongly disagree) to "7" (strongly agree). Notably, items 3 and 4 involve reverse coding. The overall satisfaction level of an individual is determined based on the cumulative score of the provided responses, with higher scores indicating increased satisfaction. The total score on the scale ranges from 5 to 35.[28,29] There is no cut-off point on the scale. The Cronbach's alpha previously identified as 0.73,[29] in this study it was 0.86.

Statistical Analysis

The analysis of research data was conducted using the Statistical Package for the Social Sciences 22.0 software package. The normal distribution of the data was determined by employing skewness and kurtosis coefficients. Pearson Correlation Analysis and Hierarchical Linear Regression Analysis were utilized to elucidate relationships and effect between the variables. Cronbach's Alpha was employed to determine the internal consistency of the scales.

Ethical Approval

Approval for ethical considerations was secured from the Social and Human Sciences Research Ethics Board of the respective university (Approval Number: 2021/387; Decision Date: April 30, 2021), and authorization was obtained from the institution where the research took place (Date: May 06, 2021–Reference: E.42691). Informed written consent was obtained from the sampled patients. The research was carried out considering the principles of the Helsinki Declaration.

RESULTS

Among liver transplant recipients, it was determined that 53.3% were male, 84.1% were married, 31.3% had completed primary education, 41.6% had three or more children, 43% lived in urban areas, 73.8% were employed, 46.7% had a moderate income level, and the mean age was 48.15 (standard deviation [SD]=11.50). Examining the health-related characteristics of the participants, it was found that 94.4% had health insurance, 71.5% received assistance for care from someone, 34.6% had a chronic illness other than transplantation, 64% underwent LT due to hepatitis, and the average time elapsed

Table 1. The distribution of individuals according to their demographic characteristics (n=214)

Characteristics	n	Percentage
Age, years (mean±SD)	48.15±11.50	(min-max: 19–70 years)
Duration after transplantation, months (mean±SD)	23.72±18.26	1–82 months
Gender		
Female	100	46.7
Male	114	53.3
Marital status		
Single	34	15.9
Married	180	84.1
Education level		
Illiterate	50	23.4
Literate	13	6.1
Primary school	67	31.3
Middle school	30	14.0
High school	38	17.8
University	16	7.5
Number of children		
No children	46	21.5
1–2 children	79	36.9
3 children and above	89	41.6
Place of residence		
City center	92	43.0
District	73	34.1
Village	49	22.9
Employment status		
Employed	56	26.2
Unemployed	158	73.8
Income level		
Good	28	13.1
Moderate	100	46.7
Poor	86	40.2
Presence of health insurance		
Yes	202	94.4
No	12	5.6
Presence of a person providing assistance for care		
Yes	153	71.5
No	61	28.5
Presence of chronic disease other than transplantation		
Yes	74	34.6
No	140	65.4
Reason for liver transplantation		
Hepatitis (B-C-Toxic-Autoimmune-Fulminant)	137	64.0
Hepatocellular carcinoma	29	13.6
Cirrhosis (cryptogenic Liver-Wilson-biliary)	35	16.4
Budd-chiari	6	2.8
Other*	7	3.2

*HPA: Hepatorenal syndrome-hydatid cysts.

after transplantation was 23.72 months (SD=18.26) (Table 1).

The mean total score for the SWBS among liver transplant recipients was 40.85±3.46, indicating a high level of spiritual well-being. The mean total score for the CDS was found to be 80.10±6.68, suggesting a high level of independence in meeting care needs. Participants' mean total score on the CLAS was 10.78±3.43, indicating low life satisfaction. The relationships between SWBS, CDS, CLAS, age, and time elapsed since transplantation for liver transplant recipients are shown in Table 2. A moderate, positive, and significant relationship was found between CDS and CLAS ($r=0.604$, $p<0.01$), while a low, positive, and significant relationship was observed between SWBS and CLAS ($r=0.271$, $p<0.01$) (Table 2).

A hierarchical linear regression analysis was conducted to determine the effect of demographic variables, care dependency, and spiritual well-being on individuals' contentment with life. Before the regression analysis, pairwise relationships between demographic variables and the CLAS were examined. Variables that showed a statistically significant relationship with the CLAS were included in the regression model, and some categorical variables were transformed into dummy variables. Model 1 revealed a significant model where gender, the presence of health insurance, and having a chronic illness other than transplantation explained 11% of the variance in life satisfaction ($F_{(3,210)}=10.432$; $p<0.001$, Adj. $R^2=0.11$). Gender ($\beta=-1.052$; $p<0.05$), the presence of health insurance ($\beta=2.429$; $p<0.05$), and the presence of a chronic illness ($\beta=-1.973$; $p<0.001$) are statistically significantly linked with life satisfaction. It was determined that female liver transplant recipients have lower levels of life satisfaction. In addition, transplant recipients with health insurance exhibit higher life satisfaction (Table 3). Subsequently, the spiritual well-being variable was added to the model, creating Model 2. The variables significantly explained 15% of the variance in life satisfaction with a 4% increase ($F_{(4,209)}=10.684$ $p<0.001$, Adj. $R^2=0.15$, R^2 Change=0.04). In Model 2, a significant and positive relationship was revealed between spiritual well-being and life satisfaction ($\beta=0.203$; $p<0.01$). Individuals with higher spiritual well-being exhibit higher life satisfaction (Table 3). In the final step, care dependency was added to the model. In Model 3, care dependency significantly explained 37% of the variance in life satisfaction with a 22% increase ($F_{(5,208)}=26.855$; $p<0.001$, Adj. $R^2=0.37$, R^2 Change=0.22). A positive and significant relationship was identified between the level of independence in care and life satisfaction ($\beta=0.290$; $p<0.001$). As the level of independence in care increased among liver transplant recipients, their life satisfaction also increased (Table 3).

Table 2. The mean, standard deviation, and correlation values of the variables

Variables	Mean	SD	α		1	2	3	4	5
1. Age	48.15	11.50	-	r	-				
				p	-				
2. Duration after transplantation	23.72	18.26	-	r	0.420**	-			
				p	**0.000**	-			
3. SWBS	40.85	3.46	0.53	r	0.124	0.043	-		
				p	0.117	0.973	-		
4. CDS	80.10	6.68	0.95	r	**–0.266****	0.083	**0.403****	-	
				p	**0.000**	0.226	**0.000**	-	
5. CLAS	10.78	3.43	0.89	r	–0.123	0.110	**0.271****	**0.604****	-
				p	0.072	0.109	**0.000**	**0.000**	-

p: Statistical significance **p<0.01; SD: Standard deviation; α: Cronbach alpha; r: Correlation coefficient; SWBS: Spiritual Well-being scale; CDS: Care dependency scale; CLAS: Contentment with life scale.

Table 3. Hierarchical linear regression models for contentment with life

Dependent variable	Regression models	Independent variables	β	95% CI	t	p	VIF	DW
CLAS	Model 1	Constant	9.670	7.757; 11.583	9.966	0.000		1.761
		Gender (Female)	–1.052	–1.925; –0.179	–2.376	0.018	1.004	
		Presence of health insurance (Yes)	2.429	0.530; 4.328	2.522	0.012		
		Presence of chronic disease other than transplantation (Yes)	–1.973	–2.889; –1.056	–4.242	0.000	1.011 1.006	
	Model 2	Constant	18.022	12.510; 23.534	6.446	0.000		
		Gender (Female)	–0.974	–1.830; –0.118	–2.243	0.026	1.008	
		Presence of health insurance (Yes)	2.237	0.374; 4.100	2.367	0.019	1.015	
		Presence of chronic disease other than transplantation (Yes)	–1.684	–2.599; –0.769	–3.627	0.000	1.047	
		SWBS	0.203	0.077; 0.330	3.176	0.002	1.049	
	Model 3	Constant	–12.958	–21.404; –4.513	–3.025	0.003		
		Gender (Female)	–0.739	–1.475; –0.003	–1.980	0.049	1.013	
		Presence of health insurance (Yes)	1.932	0.332; 3.531	2.381	0.018	1.017	
		Presence of chronic disease other than transplantation (Yes)	–0.150	–1.008; 0.708	–0.345	0.731	1.251	
		SWBS	0.023	–0.093; 0.139	0.391	0.696	1.198	
		CDS	0.290	0.225; 0.356	8.728	0.000	1.439	

Model values; Model 1: F=10.432; adjusted R^2=0.11; Model 2: F=10.684; adjusted R^2=0.15; R^2 change=0.04; Model 3: F=26.855; adjusted R^2=0.37; R^2 change=0.22; p<0.05; β: Unstandardized beta coefficient, 95% CI: 95.0% confidence interval for β, DW: Durbin-Watson, VIF: Variance inflation factor, SWBS: Spiritual Well-being scale, CDS: Care dependency scale, CLAS: Contentment with life scale

DISCUSSION

Liver transplant recipients were found to have a good level of care independence and were independent in meeting their care needs. This result is consistent with individuals who underwent major surgical procedures in the literature.[7,8,23] It is believed that this is associated with the success of the surgery and the quality of nursing care provided afterward. In addition, this study reveals that care dependency explains a significant percentage of life satisfaction, and there is a moderate, positive, and significant relationship between them. It is assumed that this relationship is associated with individuals having high independence, the absence of different chronic illnesses other than the transplant indication, the ability to survive due to LT surgery, and the inclusion of mostly younger recipients in the study.

When examining the total scores obtained from the SWBS, it is evident that transplant recipients have a high level of spiritual well-being. Spiritual well-being is considered an important component for coping with challenges.[12] In this context, it can be said that the recipients utilize spirituality to cope with the challenges of the post-operative period. Furthermore, the high level of spiritual well-being in recipients may be attributed to the cultural norm in Türkiye, where individuals generally stay with their close relatives during the post-operative period, and their relatives provide physical, emotional, and social support. In this study, a positive and significant relationship was found between individuals' spiritual well-being and their contentment with life. Therefore, it can be stated that spiritual well-being enhances contentment with life, a result consistent with many studies in the literature.[20-22] The reason behind this may be that as spiritual well-being increases, individual control and independence also increase, leading individuals to become more aware of the meaning and purpose of life. The study also indicates that transplant recipients often perceive post-transplant life as a second chance at life.[30]

Life satisfaction is a subjective evaluation individuals make about their own lives.[19] In this sense, recipients have not been able to form a positive outlook on their post-operative lives. Most studies in the literature have found moderate levels of life satisfaction in elderly and healthy individuals.[19,20] This result differs from the findings of this study. It is thought that the reason for this difference is that the liver transplant recipients in the present study are younger and have undergone a vital surgical intervention. In addition, the fact that recipients are married and employed, and most of them have three or more children, may lead to disruptions in their roles after LT. Another factor may be the recipients' sense of responsibility toward their relatives who donated organs for living donor LT. These variables are crucial factors for life satisfaction. In line with this, the study supports that recipients with health insurance have higher levels of life satisfaction. In this context, the absence of economic difficulties regarding healthcare expenses and the sense of security in terms of accessing healthcare services may have influenced life satisfaction. This is because recipients in the post-operative period after LT may be unable to work for a while due to the possibility of developing infections and rejection.[17] In this study, no significant difference was found in terms of age and life satisfaction. A possible explanation for this finding could be related to the majority of recipients in the study being young and remaining employed. Unemployment and early retirement are significant issues after LT.[17] These issues affect individuals' life satisfaction by influencing their ability to meet daily needs, access healthcare, and receive sufficient social support.[31] In addition, the chronic and progressive nature of diseases, degenerative processes, prolonged exposure to symptoms, and complications deeply impact patients and alter their life satisfaction. However, the majority of recipients in the study do not have a different chronic illness apart from the transplant etiology. This situation may have contributed to the lower level of care dependence. In addition, advancements in surgical procedures and post-operative care, along with mobilizing patients as soon as possible after the operation, are crucial for increasing independence.[23] These variables may also enhance life satisfaction. Furthermore, the presence of recipients' family members after surgery, providing support in every aspect, may have influenced life satisfaction. A study conducted on orthopedic patients examined life satisfaction in terms of gender differences, revealing results similar to this study, where men had higher life satisfaction. This outcome suggests that female recipients may be more affected by their health condition and LT.

CONCLUSION

The gender, presence of chronic illness, health insurance status, care dependency, and spiritual well-being of the liver transplant recipients in the study affect their satisfaction of life. In light of these results, it is crucial for organ transplant nurses to provide care by considering the individual characteristics of patients in the post-operative period. This approach is deemed highly important for enhancing patients' quality of life, expediting their recovery, and preventing complications. It is anticipated that nursing care offered with this perspective will have high quality, leading to increased patient satisfaction and improved quality of life. Therefore, it is recommended that the variables affecting patients' life satisfaction after LT are carefully considered and routinely evaluated in clinics. It is also recommended that this study is conducted with other organ transplant patients and recipients of cadaveric transplants, with interventional studies planned.

DECLARATIONS

Ethics Committee Approval: The study was approved by Ondokuz Mayıs University Ethics Committee (No: 2021/387, Date: 30/04/2021).

Informed Consent: Written consent was obtained from patients

Conflict of Interest: The authors declare that there is no conflict of interest.

Funding: The authors received no financial support for the research and/or authorship of this article.

Use of AI for Writing Assistance: Not declared.

Authorship Contributions: Concept – Öİ; Design – Öİ, HS; Supervision – Öİ, HS; Fundings – Öİ, HS; Materials – Öİ, HS; Data collection &/or processing – HS, Öİ; Analysis and/or interpretation – Öİ, HS; Literature search – Öİ, HS; Writing – Öİ, HS; Critical review – Öİ.

Peer-review: Externally peer-reviewed.

REFERENCES

1. Ferrarese A, Cattelan A, Cillo U, Gringeri E, Russo FP, Germani G, et al. Invasive fungal infection before and after liver transplantation. World J Gastroenterol 2020;26:7485–96.
2. Åberg F. Quality of life after liver transplantation. Best Pract Res Clin Gastroenterol 2020;46-47:101684.
3. Akbulut S, Ozer A, Saritas H, Yilmaz S. Factors affecting anxiety, depression, and self-care ability in patients who have undergone liver transplantation. World J Gastroenterol 2021;27:6967–84.
4. Kapıkıran G, Özkan M. The effect of foot reflexology on pain, comfort and beta endorphin levels in patients with liver transplantation: A randomized control trial. Eur J Integr Med 2021;45:101344.
5. Dijkstra A, Hakverdioğlu G, Muszalik M, Andela R, Korhan EA, Kędziora-Kornatowska K. Health related quality of life and care dependency among elderly hospital patients: An international comparison. Tohoku J Exp Med 2015;235:193–200.
6. Yilmaz FT, Yildiz E, Cevik BE, Unver Z. Care dependency in individuals with chronic physical disease: Its relationship with compliance to treatment and life satisfaction. Ann Med Res 2020;27:1989–98.
7. Koç S, Büker N, Şavkın R, Kıter E. Ortopedi ve travmatoloji hastalarının bağımsızlık ve depresyon düzeylerinin hemşirelik bakımından memnuniyet düzeyi üzerine etkisi. J Kartal TR 2012;23:130–6. [Article in Turkish]
8. Kılıç HF, Cevheroğlu S, Görgülü S. Determination of care dependency level of patients staying in medical and surgical clinics. DEUHFED.2017;10:22–8.
9. Kwame A, Petrucka PM. A literature-based study of patient-centered care and communication in nurse-patient interactions: Barriers, facilitators, and the way forward. BMC Nurs 2021;20:158.
10. Gultekin A, Kavak F, Ozdemir A. The correlation between spiritual well-being and psychological resilience in patients with liver transplant. Medicine 2019;8:531–6.
11. Moal-Ulvoas G. Positive emotions and spirituality in older travelers. Ann Tour Res 2017;66:151–8.
12. Zadworna-Cieślak M. Spirituality, satisfaction with life and health-related behavior of older residents of long-term care institutions-a pilot study. Explore (NY) 2020;16:123–9.
13. Clark CC, Hunter J. Spirituality, spiritual well-being, and spiritual coping in advanced heart failure: Review of the literature. J Holist Nurs 2019;37:56–73.
14. Fehring RJ, Miller JF, Shaw C. Spiritual well-being, religiosity, hope, depression, and other mood states in elderly people coping with cancer. Oncol Nurs Forum 1997;24:663–71.
15. Connerton CS, Moe CS. The essence of spiritual care. Creat Nurs 2018;24:36–41.
16. Gülnar E, Özveren H, Tüzer H, Yılmazer T. An investigation of pain beliefs, pain coping, and spiritual well-being in surgical patients. J Relig Health 2022;61:4028–38.
17. Iseri O, Karayurt O, Yilmaz S. The effects of individualized education on depression, anxiety, quality of life in liver transplant recipients. Int J Caring Sci 2021;14:1917–30.
18. Pan Y, Chan SHW, Xu Y, Yeung KC. Determinants of life satisfaction and self-perception of ageing among elderly people in China: An exploratory study in comparison between physical and social functioning. Arch Gerontol Geriatr 2019;84:103910.
19. Şahin DS, Özer Ö, Yanardağ MZ. Perceived social support, quality of life and satisfaction with life in elderly people. Educ Gerontol 2019;45:69–77.
20. Ghimire S, Baral BK, Karmacharya I, Callahan K, Mishra SR. Life satisfaction among elderly patients in Nepal: Associations with nutritional and mental well-being. Health Qual Life Outcomes 2018;16:118.
21. Lee YH, Salman A. The Mediating Effect of Spiritual Well-being on depressive symptoms and health-related quality of life among elders. Arch Psychiatr Nurs 2018;32:418–24.
22. Özdemir AA, Kavak Buda F, Dural G, Gültekin A. The relationship between spiritual well-being, life satisfaction and hope in elderly individuals in Turkey. J Relig Health 2023;62:3123–36.
23. Baksi A, Genç H. Cerrahi girişim geçiren hastaların bakım bağımlılığı durumlarının bakım algısı, sosyodemografik ve klinik özellikler açısından incelenmesi. Turk Klin J Nurs Sci 2020;12:465–72. [Article in Turkish]
24. Dijkstra A, Buist G, Dassen T. Nursing-care dependen-

cy. Development of an assessment scale for demented and mentally handicapped patients. Scand J Caring Sci 1996;10:137–43.

25. Yönt GH, Akın Korhan E, Khorshid L, Eşer İ, Dijkstra A. Bakım Bağımlılığı Ölçeğinin (Care Dependency Scale) yaşlı bireylerde geçerlik ve güvenirliğinin incelenmesi. Turk J Geriatr 2010;13:71. [Article in Turkish]
26. Aktürk Ü, Erci B, Araz M. Functional evaluation of treatment of chronic disease: Validity and reliability of the Turkish version of the Spiritual Well-Being Scale. Palliat Support Care 2017;15:684–92.
27. Peterman AH, Fitchett G, Brady MJ, Hernandez L, Cella D. Measuring spiritual well-being in people with cancer: The functional assessment of chronic illness therapy--Spiritual Well-being Scale (FACIT-Sp). Ann Behav Med 2002;24:49–58.
28. Lavallee LF, Hatch PM, Michalos AC, McKinley T. Development of the contentment with life assessment scale (CLAS): Using daily life experiences to verify levels of self-reported life satisfaction. Soc Indic Res 2007;83:201–44.
29. Akın A, Yalnız A. Yaşam Memnuniyeti Ölçeği (YMÖ) Türkçe formu: Geçerlik ve güvenirlik çalışması. Electron Soc Sci J 2015;14:95–102. [Article in Turkish]
30. Patel A, Agnihotri V, Ojha SK, Chandel VK, Mahato TK. Organ and tissue transplantation – a second chance of life. Int J Adv Sci Res Dev 2023;8:382–7.
31. Fazekas C, Kniepeiss D, Arold N, Matzer F, Wagner-Skacel J, Schemmer P. Health-related quality of life, workability, and return to work of patients after liver transplantation. Langenbecks Arch Surg 2021;406:1951–61.

ORIGINAL ARTICLE

European Archives of Medical Research

DOI: 10.14744/eamr.2025.77698
Eur Arch Med Res 2025;41(4):201–208

Assessing the Quality and Reliability of Pes Planus Videos on Youtube: Implications for Health Information and Patient Education

Cem Sever,[1] Enver Ipek[2]

[1]Department of Orthopedics and Traumatology, The Pearl International Hospital, Doha, Qatar
[2]Department of Orthopedics and Traumatology, Şişli Hamidiye Etfal Research and Training Hospital, Istanbul, Türkiye

ABSTRACT

Objective: To evaluate the educational quality, reliability, and popularity of YouTube videos on pes planus using standardized scoring systems and assess their value for patient education.

Materials and Methods: A YouTube search on March 01, 2024, using "Pes planus," "flatfoot," and "flatfeet" yielded 150 English-narrated videos; 103 met the inclusion criteria. Data on views, duration, likes, comments, and video power ındex (VPI) were recorded. Videos were assessed using the Journal of the American Medical Association Score (JAMAS) for reliability, the global quality score (GQS) for educational value, and the pes planus-specific score (PPSS) for content relevance. Statistical analyses included Kruskal–Wallis and Mann–Whitney U-tests.

Results: Mean scores were: JAMAS 2.07, GQS 2.67, PPSS 8.52. Physician-created videos scored significantly higher on JAMAS and GQS ($p<0.05$), while physiotherapists' videos had the highest VPI (362.8). Exercise videos had the highest VPI among content types, whereas disease lecture videos had the highest PPSS (21.8) but the lowest VPI (6.24). GQS strongly correlated with PPSS ($r=0.708$), and VPI with video views ($r=0.831$); no correlation was found between JAMAS and VPI.

Conclusion: Popular videos often lack educational value. While physician-created content is more reliable, it attracts less engagement. Enhancing digital content quality and visibility is essential for effective patient education.

Keywords: Pes planus, YouTube, Patient education, Health information quality, Digital health

Cite this article as: Sever C, Ipek E. Assessing the Quality and Reliability of Pes Planus Videos on Youtube: Implications for Health Information and Patient Education. Eur Arch Med Res 2025;41(4):201–208.

INTRODUCTION

Today, the Internet is the most accessible and fastest way to obtain information in nearly every aspect of daily life. A significant portion of internet searches is health-related.[1,2] Many individuals conduct online research before visiting a healthcare provider.[1,3] YouTube has become the world's largest media-sharing platform due to its ease of access and the widespread use of mobile devices.[3] Its vast variety of video content and users' preference for watching rather than reading make the platform particularly appealing.[4] However, YouTube does not review uploaded videos for content quality and accuracy. Many lack proper authorship or source attribution. In addition to questionable reliability, users are also exposed to commercial manipulation.[5] "Pes planus" is a term that encompasses

Address for correspondence: Cem Sever. Department of Orthopedics and Traumatology, The Pearl International Hospital, Doha, Qatar
E-mail: csever571@gmail.com **ORCID ID:** 0000-0002-3119-1327

Submitted: 06.08.2025 **Revised:** 06.09.2025 **Accepted:** 10.09.2025 **Available Online:** 20.10.2025

European Archives of Medical Research – Available online at www.eurarchmedres.org

both flexible and pathological flatfoot conditions. It ranges from benign, untreatable flexible flatfoot to symptomatic, rigid forms that may require surgical intervention.[6] The condition primarily affects the pediatric population. Parents – who are often active internet users – tend to seek information online rather than consult medical professionals.[3,7] While the quality of online video content on various medical conditions has been studied, the reliability and educational value of YouTube videos on flatfoot remain underexplored.

In this study, we hypothesized that YouTube videos about flatfoot may lack sufficient educational value for patients and their families. Therefore, we aimed to evaluate the content quality and reliability of such videos.

MATERIALS AND METHODS

On March 01, 2024, a YouTube search (https://www.youtube.com) was conducted using the keywords "Pes planus, flatfoot and flatfeet." Videos were sorted using the "relevance" filter, which is YouTube's default setting. This method reflects typical user behavior, as most users rely on the top-listed results suggested by the algorithm. From the approximately 11,000, 140,000, and 240,000 results returned for each keyword, respectively, the first 50 videos per keyword were selected, based on the assumption that most users do not browse beyond the first two result pages. A total of 150 English-narrated videos were initially recorded. Forty-one duplicate videos were excluded. Duplicates were defined as videos with identical narration, visuals, or reuploads by the same or different users. In such cases, only the version with the highest number of views was included. Six additional videos were excluded because their comment sections were disabled. Since user interaction (likes, dislikes, comments) is essential for calculating engagement and the video power index (VPI), videos without comment functionality were excluded. For the remaining 103 videos, data on video duration, number of views, time since upload, view rate (total views/day), number of comments, likes, and dislikes, and their like ratios (like×100/[Like+Dislike]) were collected. VPI was calculated using the following formula: VPI=(Like Ratio [%]×View Rate [views/day])/100.

This formula has been adapted from previous studies evaluating YouTube video popularity metrics in health-related research. The like ratio was calculated as: Likes×100/(likes+dislikes). Since YouTube disabled the public dislike count in 2021, the number of dislikes was estimated using the "Return YouTube Dislike" browser extension, which has been validated and used in earlier publications. This tool estimates the number of dislikes using crowd-sourced user interactions and historical data, and has been validated and used in previous studies.

Video popularity was evaluated using the benchmark criteria of the Journal of the American Medical Association (JAMA) (Table 1) and overall content quality was assessed using the global quality score (GQS) (Table 2) which is commonly applied to health-related websites. The educational value of each video was assessed using a five-point scale adapted from Singh et al.[8] (Table 2). Videos were rated using by JAMA Score (JAMAS) for reliability and GQS for educational and informational content.[8-11] All videos were evaluated by a single reviewer with a background in orthopedic surgery. Therefore, inter-rater reliability metrics, such as Cohen's kappa were not applicable in this study.

In this study, video content was more comprehensively evaluated using the Pes Planus-Specific Score (PPSS), which assessed disease-specific features, including diagnosis, classification, treatment options, and complications related to pes planus, flatfoot, and flatfeet. This scoring system was originally

Table 1. The benchmark criteria of the Journal of the American Medical Association

Benchmark criteria	Description
Authorship	Authors and contributors, their affiliations, and relevant credentials should be provided.
Attribution	References and sources for all content should be listed clearly, and all relevant copyright information noted.
Disclosure	Website 'ownership' should be prominently and fully disclosed, as should any sponsorship, advertising, underwriting, commercial funding arrangements or support, or potential conflicts of interest.
Currency	Dates that content was posted and updated should be indicated.

Table 2. Global quality score for educational value

Score	Quality Description	Interpretation
1	Poor quality	Very unlikely to be of any use to patients.
2	Poor quality, but some information present	Of very limited use to patients.
3	Suboptimal flow, some information covered, but important topics missing	Somewhat useful to patients.
4	Good quality and flow, most important topics covered	Useful to patients.
5	Excellent quality and flow	Highly useful to patients.

developed by Mathur et al.[7] to evaluate the quality of online information about scoliosis. It was later adapted by Staunton et al.[5] for scoliosis videos, and by Erdem et al.[3] for kyphotic deformity content. Based on expert consensus and relevant literature, the scale was revised to suit flatfoot-related video content. In the PPSS, each correctly presented term or concept in the video (either spoken or written) earns 1 point, with a checklist ranging from 0 to 36 items.

The final revised version of PPSS used in this study contains 32 subcategories focusing on various aspects of the disease and its treatment, each assigned 1 point, for a maximum possible score of 32 points. These categories include: Foot and arch deformities (medial, lateral, and transverse arches), ankle and subtalar joint involvement, gait abnormalities, pain, diagnostic tools, such as radiographic measurements (Meary's angle, talonavicular coverage angle, calcaneal pitch), conditions, including ligamentous laxity, tarsal coalition, Achilles tendon contracture, and congenital vertical talus, clinical tests (e.g., Jack toe rise test, pedobarographic measurements), deformities, such as heel valgus and tibial/femoral rotational abnormalities, treatment options (e.g., orthoses, exercises, shoe inserts, taping, and surgeries, including arthroereisis, osteotomy, and arthrodesis), disease progression, implant failure, and psychosocial implications.

The videos were categorized into eight groups based on source and content.

By source, the categories were: (a) Physiotherapist, (b) Podiatrist, (c) Physician, (d) Animator, (e) Academic Staff, (f) Patient, (g) Coach, (h) Merchant (Fig. 1). Based on content, the videos were grouped into: (a) Disease Lecture, (b) Surgical Technique Animation, (c) Disease Information, (d) Medical History, (e) Foot Orthotic Advertising, (f) Surgical Technique, (g) Chiropractic Treatment, and (h) Exercise Training (Fig. 2).

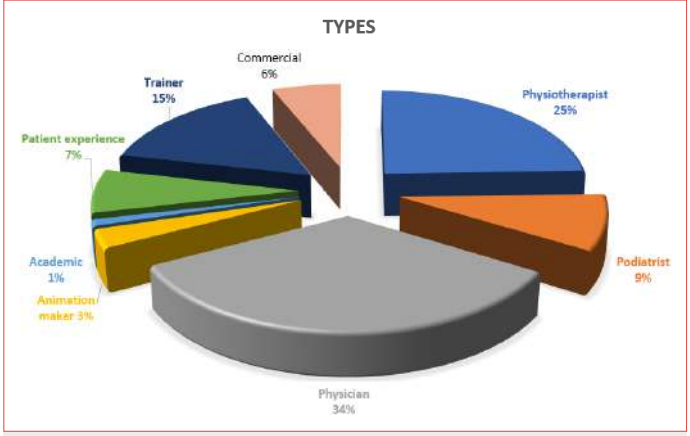


Figure 1. Distribution of video sources included in the study. Videos were categorized based on their creators: Physicians, physiotherapists, podiatrists, academic staff, patients, coaches, animators, and merchants.

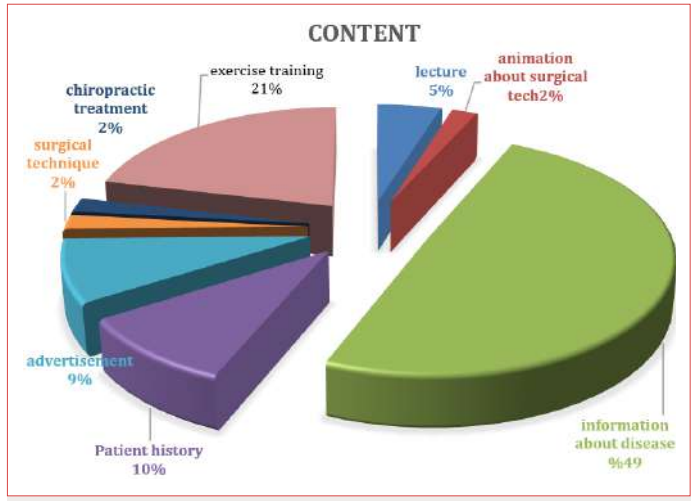


Figure 2. Categorization of video content types. Videos were classified into eight categories: Disease lecture, surgical technique, disease information, medical history, orthotic advertisement, chiropractic treatment, surgical animation, and exercise training.

Statistical Analysis

Statistical analyses were performed using IBM Statistical Package for the Social Sciences Statistics version 26. Since most variables were ordinal or categorical, and continuous variables did not follow a normal distribution, non-parametric tests were applied. The Kruskal–Wallis H test was used to compare more than two groups, and the Mann–Whitney U-test was applied for pairwise comparisons. To assess the magnitude of group differences, effect sizes were calculated: η^2 for Kruskal–Wallis and r for Mann–Whitney U. Spearman's rho correlation was used to examine associations between variables. A $p<0.05$ was considered statistically significant in all analyses.

Ethical Statement

This study involved the analysis of publicly available online content (YouTube videos) and did not include any human participants or patient data. Therefore, ethical approval was not required in accordance with institutional and international guidelines.

RESULTS

A total of 103 videos that met the inclusion criteria were analyzed. The combined total duration of these videos was 46,116 s, with an average length of 448±621 s per video. The videos had a cumulative view count of 8,011,030, averaging 77,777±176,594 views per video. The mean time elapsed since upload was 1,239±809 days. On average, videos received an average of 113±321 comments, 966±2,538 likes, and 39±79 dislikes, with an average like ratio of 93±13. One video was ex-

cluded from the study due to having zero likes, which made the VPI calculation infeasible.

The mean scores for the evaluated parameters were: JAMAS: 2.07±0.62, GQS: 2.67±0.96, and PPSS: 8.52±7.22. Videos produced by physicians had significantly higher JAMAS and GQS scores compared to those created by physiotherapists, patients, and coaches ($p<0.05$). Physician videos also achieved significantly higher PPSS scores than those from patients, coaches, and merchants ($p<0.05$). However, videos created by physiotherapists had the highest VPI values (362.8±1,141.83), significantly surpassing those from physicians and merchants ($p<0.05$). Conversely, videos by physicians and podiatrists had significantly lower VPI scores compared to those from coaches ($p<0.05$).

Content-based analysis revealed no significant differences among video types regarding JAMAS scores ($p>0.05$). However, there were significant differences in GQS, PPSS, and VPI scores across content categories ($p<0.05$). Videos categorized as disease information had significantly lower GQS and PPSS scores compared to disease lecture videos ($p<0.05$) yet scored higher than those labeled exercise training, advertisements, and medical history ($p<0.05$). Exercise training videos showed significantly higher VPI scores than all other content categories, including disease information, animations, disease lectures, surgical techniques, advertisements, and medical history, except for chiropractic treatment ($p<0.05$) (Table 3). In addition to p-values, effect sizes were reported, with values, such as $\eta^2=0.12$ (moderate) for GQS by content, and $r=0.45$ (moderate) for PPSS by video source.

Correlation analyses revealed a moderate, positive, and statistically significant correlation between JAMAS and GQS scores ($r=0.445$, $p<0.01$) as well as between JAMAS and PPSS scores ($r=0.412$, $p<0.01$). These findings indicate that higher reliability scores (JAMAS) were associated with better educational quality (GQS) and more comprehensive content (PPSS). No significant correlations were observed between JAMAS and VPI, or between JAMAS and the number of views ($p>0.05$). A strong, positive, and significant correlation was identified between GQS and PPSS ($r=0.708$, $p<0.01$), suggesting alignment between educational quality and topic-specific depth. A weak but significant correlation was also found between GQS and number of views ($r=0.195$, $p<0.05$), while no significant relationship was detected between GQS and VPI ($p>0.05$).

Table 3. Mean and Median JAMAS, GQS, PPSS and VPI values of the videos based on source and content

	PPSS	GQS	JAMAS	VPI
Video source				
Physiotherapist	5.47±3.18 (5)	2.47±0.79 (2)	1.91 ±0.51 (2)	362.8±1141.83 (101.94)
Podiatrist	10.4±6.58 (9)	2.9±0.99 (3)	2.1±0.56 (2)	19.09±22.1 (17.49)
Physician	12.73±9.16 (10.5)	3.32±0.91 (3)	2.41±0.6 (2)	30.84±60.4 (10.65)
Animator	10±5.94 (10)	2.75±0.95 (2.5)	2±0.81 (2)	10.75±11.05 (7.84)
Academic Staff	21	4	1	2.09
Patient	3.75±2.49 (3)	1.87±0.35 (2)	1.75±0.7 (2)	24.5±31.69 (16.43)
Coach	6.37±4.42 (5,5)	2.25±0.57 (2)	1.87±0.61 (2)	135.42±161.13 (71.67)
Merchants	3.14±1.77 (3)	1.57±0.53 (2)	2±0 (2)	1.65±2.02 (0.93)
Total	8.52±7.22 (6)	2.67±0.96 (2)	2.07±0.62 (2)	116.55±552.78 (18.65)
Video content				
Disease Lecture	21.8±8.46 (21)	4±0.7(4)	2.2±0.83 (2)	6.24±7.82 (3.06)
Surgical technique animation	5.5±3.53 (5.5)	2±0 (2)	2.5±0.7(2.5)	13.65±17.88 (13.65)
Disease Information	10.6±7.57 (8)	3.07±0.95 (3)	2.19±0.63 (2)	153±777.32 (16.11)
Medical History	4.7±3.65 (3.5)	2±0.47 (2)	1.8±0.63 (2)	21.48±28.97 (15)
Foot Orthotic Advertising	3.44±1.66 (3)	1.66±0.5 (2)	1.88±0.33 (2)	31.9±64.85 (1.54)
Surgical Technique	9.5±2.12 (9.5)	3±0 (3)	2.5±0.7 (2.5)	25.33±21.73 (25.33)
Chiropractic Treatment	5.5±6.36 (5.5)	2±1.41 (2)	2±1.41 (2)	253.37±354.82 (253.37)
Exercise Training	4.95±2.86 (4.5)	2.27±0.45 (2)	1.9±0.52 (2)	138.16±140.79 (106.46)
Total	8.52±7.22 (6)	2.67±0.96 (2)	2.07±0.62 (2)	116.55±552.78 (18.65)

JAMAS: Journal of the American Medical Association Score; GQS: Global quality score; PPSS: Pes planus-specific score; VPI: Video power index.

Regarding VPI and view counts, a strong, positive, and statistically significant correlation was found (r=0.831, p<0.01), indicating that videos with higher VPI scores also had greater popularity. However, no significant correlation was observed between PPSS and VPI, or between PPSS and view counts (p>0.05) (Tables 4 and 5).

DISCUSSION

The increasing number of patients diagnosed with flatfoot, combined with their families' growing tendency to seek information online before consulting a physician, formed the basis of this study's hypothesis.[1,3,7] This study aimed to evaluate the accuracy, adequacy, and quality of information on flatfoot available on YouTube, and to assess this content from a clinical perspective.

Table 4. Result summary table

Metric	Value
Total running time (seconds)	46.116
Average duration (seconds)	448±621
Total number of views	8.011.030
Average number of views	77.777±176.594
Average time since upload (days)	1.239±809
Average view rate (views/day)	121±561
Average number of comments	113±321
Average number of likes	966±2.538
Average number of dislikes	39±79
Average like rate	93±13
Average VPI	117±553
Mean JAMAS	2.07±0.62
Mean GQS	2.67±0.96
Mean PPSS	8.52±7.22

JAMAS: Journal of the American Medical Association Score; GQS: Global quality score; PPSS: Pes planus-specific score; VPI: Video power index.

Table 5. Correlations table

Correlation Pair	Correlation coefficient (r)	Significance
JAMA and GQS	0.445**	p<0.01
JAMA and PPSS	0.412**	p<0.01
GQS and PPSS	0.708**	p<0.01
GQS and Number of Views	0.195*	p<0.05
PPSS and VPI	N.S.	N.S.
PPSS and Number of Views	N.S.	N.S.
VPI and Number of Views	0.831**	p<0.01

JAMAS: Journal of the American Medical Association Score; GQS: Global quality score; PPSS: Pes planus-specific score; VPI: Video power index.

Visual content plays a crucial role in online health searches, making YouTube a preferred platform due to its accessibility and ease of use.[4] Patients tend to express satisfaction when they believe the information originates from credible sources.[12,13] However, verifying the authorship and accuracy of online video content remains a challenge for patients and their families. Prior research has shown that patients often favor visually rich and engaging videos, even when such videos lack accuracy and reliability.[3,7] This preference may mislead viewers and contribute to misinformation, potentially undermining the trust and communication between physicians and patients.

In this study, the average scores for the analyzed YouTube videos were as follows: JAMA Score (JAMAS) 2.07, GQS 2.67, and PPSS 8.52. These findings suggest that the overall quality of flatfoot-related information on YouTube is low, leaving patients with incomplete and unverified knowledge. This result is consistent with previous studies evaluating YouTube content on various medical topics, where the quality was often found to be unregulated and inconsistent.[3,5,14-18] For clinicians, addressing misconceptions shaped by unreliable online content remains a challenge, emphasizing the importance of understanding how digital environments influence patient perceptions.

When grouped by content type, 49% of the videos were classified as providing general disease information. This category yielded average scores of JAMAS: 2.19, GQS: 3.07, and PPSS: 10.6, with the highest PPSS among all content types – except for disease lecture videos (PPSS=21.8), which were predominantly created by physicians. In contrast, exercise-focused videos, mostly produced by coaches (55%) and physiotherapists (41%), emphasized practical exercises rather than comprehensive disease education. Although these videos were not always consistent or evidence-based, their practical orientation made them highly appealing to patients.

Although the correlation between GQS and number of views was statistically significant (r=0.195), the strength of the association was weak, suggesting limited clinical or educational relevance. This finding suggests that the video popularity of health-related YouTube videos may be more influenced by external engagement factors–such as compelling titles, attractive thumbnails, and professional production–than by content quality alone. Consequently, even videos with high educational value may fail to reach or engage patients effectively unless these extrinsic features are also strategically optimized.

Notably, exercise-related videos demonstrated the highest VPI scores (mean=138.16), making them the only category to surpass the overall group average. This may indicate a viewer preference for content offering practical, actionable guidance–particularly exercises that patients can integrate into their rehabilitation or treatment routines. In contrast, videos focusing on surgical procedures or general disease overviews garnered less engagement. This trend aligns with previous research emphasizing the appeal of self-applicable content in patient education.[5]

Videos promoting insoles and specialized footwear – interventions that play a significant role in the management of flat feet–had the lowest GQS (1.66) and PPSS (3.44) among all content categories. Nevertheless, their VPI score (31.9) surpassed that of disease lecture videos, indicating that promotional content may attract more attention than purely educational material.

In terms of content sources, physicians produced 34% of the videos, representing the largest contributor group. These physician-generated videos received scoring highest in JAMAS (2.41), GQS (3.32), and PPSS (12.73) – ranking second only to academic content in the latter category. Despite their high reliability and educational value, these videos exhibited a relatively low VPI scores (30.84), suggesting limited audience engagement. In contrast, videos created by physiotherapists attained the highest VPI (362.8) despite having one of the lowest PPSS scores (5.47). Academic videos, while offering the most comprehensive and accurate information (PPSS=21) and achieving a perfect GQS score, recorded the lowest VPI (2.09), reflecting minimal viewer interest. These findings align with prior research indicating a persistent mismatch between content quality and popularity on platforms, such as YouTube.[3,5,19] This discrepancy may be partly attributed to the platform's recommendation algorithm, which favors videos generating higher user engagement – such as likes, comments, and watch time – over those providing educational accuracy. Consequently, content produced by healthcare professionals, despite their high informational value, such videos may receive limited exposure, while less informative yet visually or emotionally engaging videos gain broader visibility.

Patient-generated videos had the second-lowest (PPSS: 3.75), ranking just above merchant-produced content (PPSS: 3.14). Despite their limited informational quality, these videos demonstrated relatively higher VPI values (24.5), indicating that patients tend to engage more with content produced by peers who share similar lived experiences. This suggests that emotional relatability may play a greater role in viewer engagement than informational accuracy alone.

Academic videos represented the smallest category, with only five entries in the dataset. Despite providing the highest-quality information, these videos exhibited the lowest VPI scores, reaffirming previous observations by Desai et al.[4] that instructional or rigorously structured videos tend to attract fewer views compared to less formal content.[4] Readability and visual appeal appear to play a substantial role influencing a video's reach; lower-quality videos are often perceived as more approachable or easily understandable by the general public.[5,19] Consistent with our findings, videos with lower educational value tended to be easier to read and visually accessible, whereas those with higher content scores were often perceived as less engaging or "patient-friendly."

Study Limitations

This study has several limitations that should be acknowledged. First, the analysis was restricted to the first 150 videos retrieved from YouTube using the keywords "pes planus," "flatfoot," and "flatfeet." While this sampling strategy may appear limited, it reflects typical user behavior, as the majority of internet users rarely navigate beyond the first two pages of results.[3,20]

Second, the evaluation was conducted from the perspective of a researcher, focusing on user experience rather than providing a comprehensive review of all available content related to flatfoot on YouTube. It is important to note that YouTube is a dynamic platform where content is continuously updated, and search results are influenced by various factors, such as geographic location, browsing history, and user preferences – all shaped by the platform's algorithm.

Finally, the sample size was inherently constrained to 150 videos. This limitation was necessary to ensure the feasibility of conducting an in-depth quality and reliability analysis, though it may not fully represent the breadth of flatfoot-related on the platform. Nevertheless, despite these limitations, the study provides meaningful insights into the overall quality, accessibility, and credibility of information on pes planus available through YouTube.

Although the PPSS used in this study was adapted from previously published scoring systems applied to other musculoskeletal conditions, it has not undergone formal validation specifically for pes planus–related content. As such, its accuracy and generalizability may be limited. Nevertheless, it offers a structured framework for evaluating disease-specific information in YouTube videos.

All video assessments in this study were performed by a single reviewer with a background in orthopedic surgery. While this ensured clinical expertise, it also introduces the potential

for subjective bias. Since no second reviewer was involved, inter-rater reliability (e.g., Cohen's kappa) could not be assessed. Future studies should consider using multiple independent reviewers to enhance objectivity and reproducibility.

Although several statistical comparisons were conducted in this study, adjustments for multiple testing (such as Bonferroni correction) were not applied. This decision was based on the exploratory nature of the analysis and the aim to avoid an increase in Type II errors. However, the lack of correction may increase the likelihood of Type I errors and should be considered when interpreting the results.

CONCLUSION

In the digital era, accessing health-related information has become increasingly convenient; however, verifying the accuracy and reliability of such content remains a significant challenge.[21] The absence of rigorous validation mechanisms exacerbates the risk of misinformation, posing serious implications for both patients and healthcare providers. As individuals increasingly rely on platforms, such as YouTube for medical information, the potential for misinformation threatens informed decision-making and may undermine the patient-provider relationship.

This study reveals that the majority of YouTube videos about pes planus fall short of meeting essential standards for educational quality and reliability. While videos produced by physicians were generally more trustworthy, they frequently lacked comprehensive educational depth – underscoring the need for improvement, even among otherwise high-quality sources." These findings highlight the pressing need for professional medical associations and reputable healthcare institutions to proactively engage in the creation of accurate, patient-oriented, evidence-based video content. By ensuring the availability of reliable and accessible information, these organizations can play a pivotal role in combating digital health misinformation and promoting public health literacy. To address this, collaborations between healthcare professionals and digital media experts may be instrumental in producing content that balances medical accuracy with viewer engagement. Such partnerships offer a promising strategy to bridge the existing gap between content quality and reach, ensuring that trustworthy health information is both visible and impactful for a broader audience.

DECLARATIONS

Ethics Committee Approval: This study involved the analysis of publicly available online content (YouTube videos) and did not include any human participants or patient data. Therefore, ethical approval was not required in accordance with institutional and international guidelines.

Informed Consent: Since the study exclusively analyzed publicly accessible content on YouTube, no informed consent was required. The videos used in this research were openly available to the general public, and no individuals were directly involved or identified in the study.

Conflict of Interest: The authors declare that there is no conflict of interest.

Funding: The authors received no financial support for the research and/or authorship of this article.

Use of AI for Writing Assistance: Not declared.

Authorship Contributions: Concept – CS; Design – CS; Supervision – CS; Fundings – CS, Eİ; Materials – CS, Eİ; Data collection &/or processing – CS; Analysis and/or interpretation – Eİ; Literature search – CS, Eİ; Writing – CS, Eİ; Critical review – CS.

Peer-review: Externally peer-reviewed.

REFERENCES

1. Wright JE, Brown RR, Chadwick C, Karadaglis D. The use of the Internet by orthopaedic outpatients. J Bone Joint Surg Br 2001;83:1096–7.
2. Jariwala AC, Kandasamy, Abboud RJ, Wigderowitz CA. Patients and the Internet: a demographic study of a cohort of orthopaedic out-patients. Surgeon 2004;2:103–6.
3. Erdem MN, Karaca S. Evaluating the accuracy and quality of the information in kyphosis videos shared on YouTube. Spine (Phila Pa 1976) 2018;43:E1334–9.
4. Desai T, Shariff A, Dhingra V, Minhas D, Eure M, Kats M. Is content really king? An objective analysis of the public's response to medical videos on YouTube. PLoS One 2013;8(:e82469.
5. Staunton PF, Baker JF, Green J, Devitt A. Online curves: a quality analysis of scoliosis videos on YouTube. Spine (Phila Pa 1976) 2015;40:1857–61.
6. Tareco JM, Miller NH, MacWilliams BA, Michelson JD. Defining flatfoot. Foot Ankle Int 1999;20:456–60.
7. Mathur S, Shanti N, Brkaric M, Sood V, Kubeck J, Paulino C, et al. Surfing for scoliosis: the quality of information available on the Internet. Spine (Phila Pa 1976) 2005;30:2695–700.
8. Singh AG, Singh S, Singh PP. YouTube for information on rheumatoid arthritis--a wakeup call? J Rheumatol 2012;39:899–903.
9. Silberg WM, Lundberg GD, Musacchio RA. Assessing, controlling, and assuring the quality of medical information on the internet: caveant lector et viewor--Let the reader and viewer beware. JAMA 1997;277:1244–5.
10. El Choueiri J, Caimi E, Pellicanò F, Laurelli F, Guerini F, Citro G, et al. YouTube as a tool for medical education: analyzing content quality and reliability on chiari malformation.

World Neurosurg 2024;192:e259–66.

11. El-Mahrouk M, Jaradat D, Eichler T, Sucher R, Margreiter C, Lederer A, et al. "YouTube" for surgical training and education in donor nephrectomy: friend or foe? J Med Educ Curric Dev 2025;12:23821205241301552.
12. Hungerford DS. Internet access produces misinformed patients: managing the confusion. Orthopedics 2009;32:orthosupersite.com/view.asp?rID=42830.
13. Sechrest RC. The internet and the physician-patient relationship. Clin Orthop Relat Res 2010;468:2566–71.
14. Brooks FM, Lawrence H, Jones A, McCarthy MJ. YouTube™ as a source of patient information for lumbar discectomy. Ann R Coll Surg Engl 2014;96:144–6.
15. Madathil KC, Rivera-Rodriguez AJ, Greenstein JS, Gramopadhye AK. Healthcare information on YouTube: A systematic review. Health Informatics J 2015;21:173–94.
16. Fischer J, Geurts J, Valderrabano V, Hügle T. Educational quality of YouTube videos on knee arthrocentesis. J Clin Rheumatol 2013;19:373–6.
17. Garg N, Venkatraman A, Pandey A, Kumar N. YouTube as a source of information on dialysis: a content analysis. Nephrology (Carlton) 2015;20:315–20.
18. MacLeod MG, Hoppe DJ, Simunovic N, Bhandari M, Philippon MJ, Ayeni OR. YouTube as an information source for femoroacetabular impingement: a systematic review of video content. Arthroscopy 2015;31:136–42.
19. O'Neill SC, Baker JF, Fitzgerald C, Fleming C, Rowan F, Byrne D, et al. Cauda equina syndrome: assessing the readability and quality of patient information on the internet. Spine (Phila Pa 1976) 2014;39:E645–9.
20. Morahan-Martin JM. How internet users find, evaluate, and use online health information: a cross-cultural review. Cyberpsychol Behav 2004;7:497–510.
21. Ozturk EC, Yilmaz H, Sacaklidir R, Sencan S, Gunduz OH. YouTube as a source of information on sacroiliac joint injection: a reliability and quality analysis. Medicine (Baltimore) 2023;102:e33207.

ORIGINAL ARTICLE

European Archives of Medical Research

DOI: 10.14744/eamr.2025.83435
Eur Arch Med Res 2025;41(4):209–213

Mapping Patient-Facing Symptom Keywords for Fibromyalgia and Myofascial Pain Syndrome Using Google Trends: Implications for Clinic Communication in Türkiye (2015–2025)

Gokhan Ozkocak

Department of Physical Medicine and Rehabilitation, Istanbul Aydin University Faculty of Medicine, Istanbul, Türkiye

ABSTRACT

Objective: To identify symptom keywords the public most strongly associates with fibromyalgia and myofascial pain syndrome (MPS) in Türkiye, and translate these patterns into practical, symptom-first prompts for clinicians.

Materials and Methods: Monthly Google Trends CSVs (Türkiye, Health category) for July 2015–July 2025 were analyzed in two panels: (1) Fibromyalgia with numbness/tingling, fatigue, insomnia, and depression; (2) MPS with muscle pain, trigger point, joint pain, and kyphosis. Within-CSV terms were compared on levels; between panels, we used correlation/shape. We computed Pearson and Spearman correlations over the full horizon, ±6-month cross-correlations, and 12-month rolling correlations.

Results: In the fibromyalgia panel, numbness/tingling showed the strongest positive, synchronous association (Pearson r=0.78; Spearman=0.79; best lag=0 months). Fatigue provided a leading signal (best lag: −6 months; r≈0.33) despite modest same-month correlation (r≈0.13). Insomnia and depression had negligible synchronous associations (r≈0 to −0.05). In the MPS panel, muscle pain had the highest average level but showed moderate negative long-horizon correlation with the disease label (r≈−0.48), similar to trigger point/kulunç (r≈−0.46) and joint pain (r≈−0.45); kyphosis was weakly positive (r≈+0.17). Cross-disease shape correlation (fibromyalgia vs. MPS) was moderately negative (r≈−0.31).

Conclusion: A symptom-first communication strategy is suggested: for fibromyalgia, lead with paresthesia (numbness/tingling) and probe fatigue with a 6-month time-course; for MPS, open with muscle pain and trigger-point language before disease labels.

Keywords: Fibromyalgia, Health communication, Internet, Myofascial pain syndromes, Trigger points, Türkiye

Cite this article as: Ozkocak G. Mapping Patient-Facing Symptom Keywords for Fibromyalgia and Myofascial Pain Syndrome Using Google Trends: Implications for Clinic Communication in Türkiye (2015–2025). Eur Arch Med Res 2025;41(4):209–213.

INTRODUCTION

In contemporary clinical practice, the dissonance between professional diagnostic terminology and patients' natural symptom descriptions often hinders effective communication and timely diagnosis. Increasingly, patients initiate their healthcare journeys through online searches, typically using symptom-based queries rather than formal disease names. This behavior highlights an opportunity: Aligning clinical interview strategies with the symptom vocabulary that patients already use could enhance rapport, increase diagnostic efficiency, and reduce unnecessary testing.

Google Trends provides an anonymized, normalized (0–100) index of relative search interest by region and time. Because indices are normalized within each query's window, they re-

Address for correspondence: Gokhan Ozkocak. Department of Physical Medicine and Rehabilitation, Istanbul Aydin University Faculty of Medicine, Istanbul, Türkiye

E-mail: gokhanozkocak@aydin.edu.tr **ORCID ID:** 0000-0003-3174-5630

Submitted: 19.08.2025 **Revised:** 30.09.2025 **Accepted:** 01.10.2025 **Available Online:** 20.10.2025

European Archives of Medical Research – Available online at www.eurarchmedres.org

veal relative peaks and co-movement rather than absolute volumes. Patients frequently seek health information using symptom words rather than diagnostic labels. Aligning interview language with patients' search vocabulary can improve rapport and shorten the path to the key complaint.[1]

Fibromyalgia is a chronic pain disorder characterized by widespread pain with common non-pain symptoms such as fatigue, non-restorative sleep, cognitive complaints, and mood symptoms. In 2016, the American College of Rheumatology (ACR) revised and unified the 2010/2011 criteria. Diagnosis is supported when: (i) Widespread pain index (WPI) ≥7 and symptom severity scale (SSS) ≥5 or WPI 4–6 and SSS ≥9; (ii) generalized pain in ≥4/5 regions; (iii) symptoms ≥3 months; valid irrespective of other diagnoses.[2,3] Myofascial pain syndrome (MPS), by contrast, is a regional musculoskeletal condition marked by hyperirritable trigger points within taut muscle bands. These points produce local and referred pain, often with palpable tenderness and local twitch responses.[4,5] In Turkish colloquial usage, "yumuşak doku romatizması" (soft-tissue rheumatism) often serves as a public-facing synonym or proxy for MPS, despite not being a formal diagnostic label.

This study aims to identify the symptom-related keywords most commonly associated with fibromyalgia and MPS in Türkiye—based on a decade of Google Trends data—and to translate these digital search behaviors into symptom-first clinical interview strategies that align with public vocabulary.

MATERIALS AND METHODS

This study employed an ecological, retrospective design to analyze monthly Google Trends data on public search interest in symptom-related terms associated with fibromyalgia and MPS in Türkiye, covering the period from July 2015 to July 2025.

Data were retrieved using the "Health" category filter, and search indices were normalized on a 0–100 scale within each query's time window, representing relative—not absolute—search interest. Due to Google's data sampling procedures, repeated exports may exhibit minor differences.[1,6-8] Two patient-facing, Turkish-language query panels were constructed. The first panel targeted fibromyalgia and included the disease label fibromyalgia alongside four symptoms: Uyuşma/karıncalanma (numbness/tingling), yorgunluk (fatigue), uykusuzluk (insomnia), and depresyon (depression). The second panel approximated MPS through the colloquial proxy yumuşak doku romatizması, paired with kas ağrısı (muscle pain), kulunç (trigger point), eklem ağrısı (joint pain), and kamburluk (kyphosis).

Statistical Analysis

CSV files were exported for each panel; values within each CSV were co-normalized, allowing level comparisons among terms in the same panel. However, due to independent normalization across panels, inter-panel analyses were restricted to shape comparisons (co-movement).[6,7] Data were parsed without smoothing; values marked "<1" were set to zero, date columns were formatted monthly, and Turkish diacritics were retained. Statistical analysis included Pearson and Spearman correlations over the full 10-year period to assess the relationship between symptom terms and the respective disease label. We also computed ±6-month cross-correlations to explore lead-lag dynamics (with negative lags indicating symptom-led signals), and 12-month rolling correlations to evaluate time-varying associations. Shape similarity between fibromyalgia and MPS panels was assessed using Pearson correlation on z-score–standardized series for overlapping months. All interpretations were grounded in the 2016 ACR diagnostic criteria for fibromyalgia[2,3] and current pathophysiological models of MPS,[4,5] with analyses considered descriptive due to the normalized and serially correlated nature of Google Trends data.[1,6-8]

RESULTS

Fibromyalgia panel—primary association and timing: Across 2015–2025, "uyuşma/karıncalanma" showed the strongest positive, same-month association with the fibromyalgia label (Pearson r=0.78; Spearman=0.79; best lag=0 months). This is consistent with sensory descriptors frequently reported in fibromyalgia, alongside generalized pain per ACR-2016. "Yorgunluk" had a modest same-month correlation (r≈0.13) but a clearer lead at –6 months (cross-correlation peak r≈0.33), which suggests population interest in fatigue may precede peaks in fibromyalgia-label interest. "Uykusuzluk" and "depresyon" displayed negligible same-month co-movement (r≈0 to –0.05) despite clinical relevance; high background usage may dilute disease-specific co-movement in infodemiology designs (Fig. 1).

Yumuşak doku romatizması (MPS proxy) panel—level prominence versus co-movement: "Kas ağrısı" had the highest average search level among symptom terms but showed a moderate negative long-horizon correlation with the disease label (r≈–0.48), similar to "kulunç" (r≈–0.46), and "eklem ağrısı" (r≈–0.45); "kamburluk" was weakly positive (r≈+0.17). Long-window negativity indicates divergent trajectories rather than semantic opposition under Google's normalization, aligning with MPS pathophysiology focused on taut bands and trigger points. Cross-disease shape comparison: Z-score–standardized series for fibromyalgia and "yumuşak doku romatizması" showed a moderately negative shape correlation (r≈–0.31), indicating counter-moving attention waves potentially shaped by media cycles, clinic coding, or seasonality (Fig. 2).

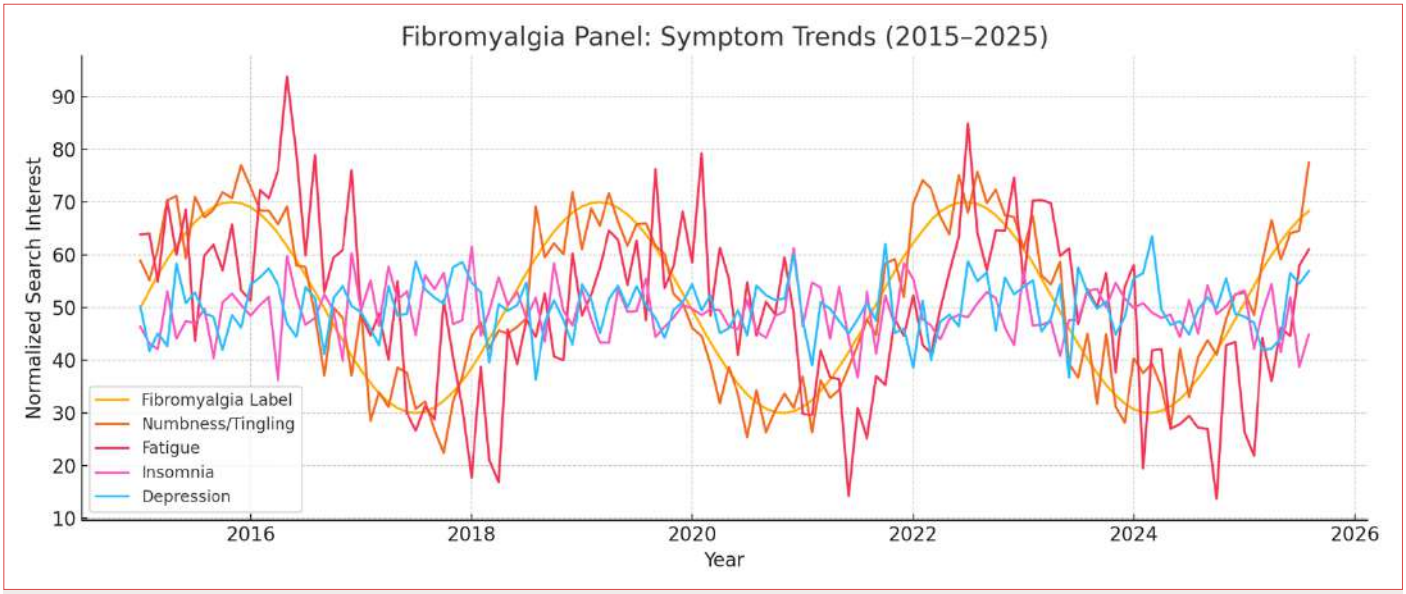


Figure 1. Monthly search trends for fibromyalgia and related symptom terms in Türkiye (2015–2025).

Normalized Google Trends indices (0–100) demonstrate a strong synchronous correlation between the term fibromyalgia and numbness/tingling (Pearson r=0.78), indicating parallel public interest over time. Fatigue showed a weaker same-month correlation (r≈0.13) but emerged as a potential lead indicator, peaking approximately 6 months before increases in fibromyalgia-related searches (cross-correlation peak r≈0.33). In contrast, insomnia and depression exhibited negligible synchronous association (r≈0 to–0.05), likely reflecting their high background frequency across unrelated contexts.

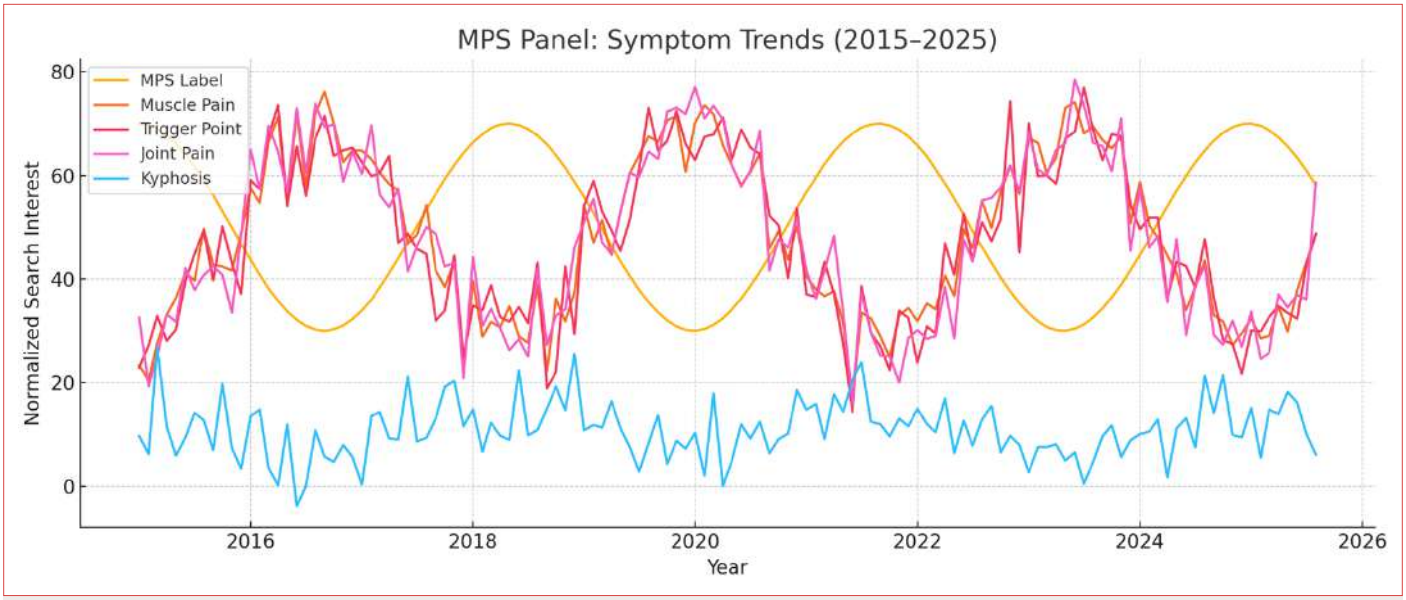


Figure 2. Monthly search trends for myofascial pain syndrome and related symptom terms in Türkiye (2015–2025)

Normalized Google Trends indices (0–100) show that muscle pain had the highest average search level but was moderately negatively correlated with the MPS label (r≈–0.48), along with trigger point and joint pain. Kyphosis displayed weak positive synchrony (r≈+0.17). These diverging trajectories suggest differing temporal attention patterns, likely shaped by symptom specificity and public familiarity.

DISCUSSION

This study makes a novel contribution by aligning public search behavior with clinical diagnostic workflows in fibromyalgia and MPS. The central insight – that patients in Türkiye most frequently associate fibromyalgia with paresthesia and that fatigue acts as a lead signal – suggests that traditional diagnostic pathways may be missing a critical opportunity to meet patients where they are at the symptom level.[9,10]

The weak search synchrony of insomnia and depression – despite their known clinical relevance–underscores the noise introduced by broad-spectrum, high-frequency symptom terms. This insight strengthens the case for refined symptom-first strategies, particularly in syndromes such as fibromyalgia, where diagnosis relies more on clinical interpretation than on biomarkers.[11,12]

Similarly, in the MPS panel, symptoms such as muscle pain, trigger points, and joint pain were dominant in absolute search level but showed negative co-movement with disease labeling. This suggests that MPS may be linguistically under-coded in patient narratives, highlighting the importance of matching clinical vocabulary with public usage.[4,5,13]

The proposed micro-algorithms offer an actionable bridge between online behavior and clinic-based assessment. In primary care, the strong co-movement between numbness/tingling and fibromyalgia justifies initiating a WPI/SSS screen when such descriptors are mentioned.[2,10]

In psychiatry and mental health, patients presenting with depression or insomnia should not be overlooked for fibromyalgia, despite weak search co-movement—particularly given the frequent clinical overlap.[9,10] In neurology, unexplained sensory complaints with a negative neurologic exam but positive WPI/SSS should trigger reconsideration of a fibromyalgia diagnosis.[11,12]

For MPS, using colloquial terms such as "kulunç" may facilitate more accurate localization, especially in PM&R, orthopedics, and physiotherapy settings. These findings encourage a shift from diagnosis-centered intake toward symptom-guided dialog, aligning with patient search behavior and clinical need.[4,5,13-15]

Regarding health communication and digital system design, a major implication lies in clinical informatics and service design. Institutions can translate symptom-language into smarter digital workflows: Embedding trigger terms such as "numbness" or "6-month fatigue" into EHRs to launch diagnostic tools (e.g., WPI/SSS).[1,6-8]

Producing training modules for clinicians on "diagnosing from symptom cues," especially for underdiagnosed conditions such as fibromyalgia. Publishing SEO-optimized content for patients – answering how and why they search: e.g., "What is kulunç?" or "Is muscle pain a sign of something deeper?" Such integration ensures that population-level language patterns actively shape clinical workflows, not just marketing or education.

Beyond the clinic, these findings have implications for public health strategy, health literacy, and patient satisfaction. In settings where health-seeking behavior begins online, identifying which symptom terms dominate public queries can support more accessible and empathetic communication in both digital and face-to-face encounters. By aligning clinical questioning with real-world language use, clinicians not only increase diagnostic efficiency and validate the patient's lived experience–an important driver of patient trust and satisfaction. Moreover, embedding symptom-first strategies into digital triage tools, EHRs, and national health education platforms may strengthen health literacy by reinforcing connections between familiar symptoms and medically meaningful syndromes. In this way, symptom-based framing becomes not just a clinical tactic, but a health systems tool for bridging the gap between public language and professional care.[16-18]

This study has several strengths and limitations. Its use of real-world, population-scale behavioral data spanning a full decade is a major strength. The normalized structure of Google Trends provides a robust foundation for analyzing the shape and co-movement of symptom interest over time, offering insight into public attention dynamics rather than absolute disease burden. However, several limitations should be acknowledged. First, Google Trends reflects relative search interest, not clinical prevalence or symptom severity. Public search behavior is susceptible to media influence, seasonality, and sociocultural factors, which may introduce noise. Moreover, each search panel is normalized independently, meaning that comparisons between disease panels (e.g., fibromyalgia vs. MPS) are limited to correlation of trends – not absolute levels.

Critically, while the study proposes symptom-first micro-algorithms for clinical use, these have not yet been validated in real-world clinical settings. Their utility remains hypothetical and should be interpreted as hypothesis-generating rather than prescriptive. Prospective validation – especially regarding diagnostic accuracy, referral efficiency, and patient-reported outcomes–is necessary before routine adoption in practice.

Future work should pursue prospective validation of the proposed micro-protocols in clinical settings–especially their ability to reduce diagnostic delays or unnecessary referrals. Additional opportunities include: Developing specialty-specific symptom panels (e.g., for rheumatology, neurology, and sleep medicine). Evaluating patient-reported outcomes after implementation of symptom-first intake flows. Studying how language localization and health literacy shape search patterns and diagnostic risk.

CONCLUSION

This study provides evidence that public search behavior can inform a symptom-first clinical framework for fibromyalgia and MPS. Paresthesia and fatigue serve as high-yield opening cues for fibromyalgia, while muscle/trigger-point language provides better alignment for MPS. Embedding these insights into intake scripts, EHR systems, and health communication strategies can improve diagnostic efficiency, reduce patient frustration, and align practice with the realities of how people think about–and search for-their symptoms.

DECLARATIONS

Ethics Committee Approval: I declare that ethical committee approval was not required because the web-based research titled "Mapping Patient-Facing Symptom Keywords for Fibromyalgia and Myofascial Pain Syndrome Using Google Trends: Implications for Clinic Communication in Türkiye (2015–2025)" was conducted without using patient data.

Conflict of Interest: The author declare that there is no conflict of interest.

Funding: Not declared.

Use of AI for Writing Assistance: Not declared.

Peer-review: Externally peer-reviewed.

REFERENCES

1. Nuti SV, Wayda B, Ranasinghe I, Wang S, Dreyer RP, Chen SI, et al. The use of google trends in health care research: a systematic review. PLoS One 2014;9:e109583.
2. Wolfe F, Clauw DJ, Fitzcharles MA, Goldenberg DL, Häuser W, Katz RL, et al. 2016 Revisions to the 2010/2011 fibromyalgia diagnostic criteria. Semin Arthritis Rheum 2016;46:319–29.
3. Kaltsas G, Tsiveriotis K. Fibromyalgia. 2023. In: Feingold KR, Ahmed SF, Anawalt B, Blackman MR, Boyce A, Chrousos G, et al., editors. Endotext. South Dartmouth (MA): MDText.com, Inc.
4. Dua A, Chang KV. Myofascial pain syndrome. Treasure Island (FL): StatPearls Publishing; 2025.
5. Steen JP, Jaiswal KS, Kumbhare D. Myofascial pain syndrome: an update on clinical characteristics, etiopathogenesis, diagnosis, and treatment. Muscle Nerve 2025;71:889–910.
6. Mavragani A, Ochoa G. Google trends in infodemiology and infoveillance: methodology framework. JMIR Public Health Surveill 2019;5:e13439.
7. Mavragani A, Ochoa G, Tsagarakis KP. Assessing the methods, tools, and statistical approaches in google trends research: systematic review. J Med Internet Res 2018;20:e270.
8. Eysenbach G. Infodemiology and infoveillance: framework for an emerging set of public health informatics methods to analyze search, communication and publication behavior on the Internet. J Med Internet Res 2009;11:e11.
9. Clauw DJ. Fibromyalgia: a clinical review. JAMA 2014;311:1547–55.
10. Macfarlane GJ, Kronisch C, Dean LE, Atzeni F, Häuser W, Fluß E, et al. EULAR revised recommendations for the management of fibromyalgia. Ann Rheum Dis 2017;76:318–28.
11. Yepez D, Grandes XA, Talanki Manjunatha R, Habib S, Sangaraju SL. Fibromyalgia and depression: a literature review of their shared aspects. Cureus 2022;14:e24909.
12. Lawson K. Sleep dysfunction in fibromyalgia and therapeutic approach options. OBM Neurobiology 2020;4:49.
13. Shah JP, Gilliams EA. Uncovering the biochemical milieu of myofascial trigger points using in vivo microdialysis: an application of muscle pain concepts to myofascial pain syndrome. J Bodyw Mov Ther 2008;12:371–84.
14. Travell JG, Simons DG, Simons LS. Travell & Simons' Myofascial Pain and Dysfunction: Upper half of body. Baltimore, MD, USA: Williams & Wilkins, 1999.
15. Shah JP, Thaker N, Heimur J, Aredo JV, Sikdar S, Gerber L. Myofascial trigger points then and now: a historical and scientific perspective. PM R 2015;7:746–61.
16. Sharkiya SH. Quality communication can improve patient-centred health outcomes among older patients: a rapid review. BMC Health Serv Res 2023;23:886.
17. Çakmak C, Uğurluoğlu Ö. The effects of patient-centered communication on patient engagement, health-related quality of life, service quality perception and patient satisfaction in patients with cancer: a cross-sectional study in Türkiye. Cancer Control 2024;31:10732748241236327.
18. Street RL Jr, Makoul G, Arora NK, Epstein RM. How does communication heal? Pathways linking clinician-patient communication to health outcomes. Patient Educ Couns 2009;74:295–301.

ORIGINAL ARTICLE

European Archives of Medical Research

DOI: 10.14744/eamr.2025.41103
Eur Arch Med Res 2025;41(4):214–221

Analysis of Online Information-Seeking Behaviors Related To Adalimumab in Türkiye Using Google Trends Data (2016–2025)

Berru Yargi Ozkocak,[1] Gokhan Ozkocak[2]

[1]Department of Ophthalmology, Beyoglu Eye Training and Research Hospital, University of Health Sciences, Istanbul, Türkiye
[2]Department of Physical Therapy and Rehabilitation, Istanbul Aydin University Faculty of Medicine, Istanbul, Türkiye

ABSTRACT

Objective: This study aims to analyze online information-seeking behaviors of patients in Türkiye regarding adalimumab by using Google Trends data.

Materials and Methods: Weekly normalized search volume index data between 2016 and 2025 were retrieved for a total of 40 keywords related to "adalimumab," "humira," "amgevita," and 10 thematic domains. The results were normalized with reference to "adalimumab." Temporal trends and regional (provincial) distributions were evaluated.

Results: The most frequently searched term was "humira," whereas "adalimumab" attracted relatively limited interest. "Amgevita" was searched at a meaningful level only in certain metropolitan areas. General knowledge, patient experience, and drug pricing emerged as dominant themes. In contrast, searches related to specific indications, such as uveitis and pharmacological features were extremely limited. A statistically significant increase in search interest was observed after 2021 ($p<0.001$).

Conclusion: Digital information-seeking behaviors about adalimumab have increased and diversified over time. The public appears to use commercial names more frequently than the generic name and shows greater interest in non-medical topics, such as pricing and patient experiences. Awareness of biosimilar medications remains limited and is geographically concentrated in specific provinces.

Keywords: Adalimumab, Biosimilar awareness, Google Trends, Online health information, Patient behavior

Cite this article as: Yargi Ozkocak B, Ozkocak G. Analysis of Online Information-Seeking Behaviors Related To Adalimumab in Türkiye Using Google Trends Data (2016–2025). Eur Arch Med Res 2025;41(4):214–221.

INTRODUCTION

Uveitis is defined as a group of inflammatory intraocular diseases, potentially resulting in permanent vision loss if left untreated. The majority of non-infectious uveitis cases are associated with systemic immunological disorders and follow a chronic course, necessitating a prolonged treatment and monitoring process after diagnosis.[1] Corticosteroids remain the first-line treatment; however, concerns have been raised regarding their long-term use, regarding its potential inadequacy, and the severity of the side effects that may be associated with their use. Biologic agents have emerged as the preferred options in the stepwise therapeutic approach.[2,3]

Address for correspondence: Berru Yargi Ozkocak. Department of Ophthalmology, Beyoglu Eye Training and Research Hospital, University of Health Sciences, Istanbul, Türkiye

E-mail: byargi@hotmail.com **ORCID ID:** 0000-0002-6801-6178

Submitted: 03.08.2025 **Revised:** 07.08.2025 **Accepted:** 12.09.2025 **Available Online:** 20.10.2025

European Archives of Medical Research – Available online at www.eurarchmedres.org

Adalimumab, an anti-TNF-α monoclonal antibody, was the first and only biologic agent to be FDA-approved in 2016 for the treatment of non-infectious intermediate, posterior, and panuveitic diseases (https://www.accessdata.fda.gov/drugsatfda_docs]/label/2018/125057s410lbl.pdf). The VISUAL I and VISUAL II clinical trials demonstrated that adalimumab significantly prolonged time to treatment failure, reduced the risk of vision loss, and enabled steroid-sparing effects.[4,5] It has been officially available in Türkiye since 2018, with prescriptions requiring approval by a committee of specialists and periodic renewal every three to six months. Nevertheless, the prolonged nature of biologic therapies gives rise to concerns regarding adherence, safety, and information needs.[6] In outpatient settings, there is limited time available for patient education, and many individuals therefore turn to publicly accessible sources, most commonly search engines, such as Google.[7]

Google Trends (GT) is an online tool that provides anonymized, time- and location-based normalized search volume index (SVI) data. Since its launch in 2004, GT has become a valuable resource for infodemiological analyses, allowing the investigation of digital information-seeking behaviors. In recent years, there has been an increasing interest in this field within the context of public health and digital health research, with particular regard to studies in the field of ophthalmology.[8-11]

The objective of this study is to analyze how individuals in Türkiye seek online information related to adalimumab using GT data, with a focus on thematic patterns, such as drug information, safety, efficacy, usage, pricing, and special situations. The temporal and geographic distribution of these queries will also be examined.

MATERIALS AND METHODS

The present study was designed as an infodemiological analysis based on GT data to assess online information-seeking behaviors regarding adalimumab in the context of uveitis treatment in Türkiye. The primary objective of the present study was to explore the temporal evolution of public interest in adalimumab and to provide a comprehensive mapping of this interest across a range of treatment-related themes.

All data were obtained from the publicly accessible GT platform; no individual data were collected, and therefore, ethical committee approval or informed consent was not required. All data were anonymous, aggregated, and derived from publicly available digital sources. The study was conducted in accordance with the Declaration of Helsinki.

Each keyword group was entered separately into the GT platform, selecting "Web Search" as the search category. The search language was set to Turkish, with the geographical region limited to Türkiye, and the time interval set from January 01, 2016 to July 14, 2025. The selected timeframe is reflective of the clinical introduction and increasing accessibility of adalimumab in Türkiye, in conjunction with evolving public habits regarding online health information. To ensure the relevance of the results to the field of medicine, the "Health" category filter was applied.

Searches were conducted utilizing the "search term" format in GT. To standardize comparisons, the term "adalimumab" was included as a fixed reference keyword in each query. This enabled the relative search volume of other terms to be indexed against adalimumab. In addition to the nomenclature of the molecule, the brand names most frequently employed in Türkiye – Humira (Humira®, AbbVie Inc., North Chicago, IL, USA) and its biosimilar Amgevita (Amgevita®, Amgen Europe B.V., Breda, The Netherlands) – were also included. Following the confirmation that "humira" was the most frequently searched brand name, subsequent queries were adapted to include this term accordingly.

The searches were organized under ten pre-defined thematic groups, each representing a distinct aspect of patient interest in adalimumab: General information, safety and side effects, efficacy and treatment success, mode and duration of administration, cost, comparisons with alternative drugs, special circumstances (e.g. pregnancy, childhood, immunosuppression), impact on vision, patient opinions and concerns, and reimbursement/reporting processes. For each group, 4–5 original Turkish keywords were created in alignment with natural language patterns used by patients. In instances where the SVI yielded a score of zero, alternative colloquial expressions were subjected to empirical investigation.

GT provides normalized weekly average scores ranging from 0 to 100, with 100 representing the peak search volume for a given time period and other terms scored proportionally. In instances where the search volume is found to be exceptionally low, or where there is a possibility of privacy risks being present, GT has been known to assign a score of "0" or to withhold data. Such characteristics were taken into account, and variables without meaningful variation were excluded from statistical analyses. The exported output files were formatted as a CSV file and subsequently organized into thematic groupings. For each file, the relative search scores of keywords were recorded against the reference term (adalimumab). The categories and keywords that were the focus of the investigation are presented in Table 1 (also see Supplementary data for the original Turkish version of the keywords).

Statistical Analysis

For each keyword within the thematic groups, descriptive statistical analyses were performed to calculate the mean, median, minimum, and maximum SVI values throughout the study

Table 1. Distribution of Google Trends search terms by thematic categories

Keywords*	General Info	Safety	Efficacy	Administration	Cost	Comparison	Special conditions	Vision-related	Patient experience	Report process
Reference†	Adalimumab (ADA)‡	ADA	ADA	ADA	ADA	ADA	ADA	ADA	ADA	ADA
K1	Humira§	Humira side effects	Is Humira effective?	How to use Humira	Humira price	Humira alternatives	Humira pregnancy	Humira blindness	What kind of drug is Humira	Humira report
K2	Amgevita	Amgevita side effects	Benefits of Humira	Humira dosing schedule	Amgevita price	Humira versus Amgevita	Humira in children	Can Humira restore vision	Humira reviews	Humira report duration
K3	ADA uveitis	ADA side effects	Is Humira effective	Humira injection	Humira SGK	What can be used instead of humira	Humira vaccine	Does humira save eyesight	What users say about Humira	Humira and TBC
K4	Humira uveitis	Is ADA harmful?	When does Humira work?	Humira pen	Humira reimbursement	Humira or corticosteroids	Humira breastfeeding	Humira and glasses	Amgevita user opinions	Humira and cancer

K: Keywords; ADA: Adalimumab; SGK: Sosyal güvenlik kurumu (in Turkish)- social security organization. *Keywords were selected based on natural language patterns that patients are likely to use. †"Adalimumab" was used as the fixed reference term in all GT queries. ‡Searches were conducted using the full name "Adalimumab"; ADA is used here for tabular clarity. §Since "Humira" was the most frequently searched term, other thematic queries were built around it.

period. The relative distribution of interest across thematic categories was expressed proportionally. To assess temporal trends, annual mean SVI values were analyzed to determine whether changes over time showed statistically significant differences. Given the non-parametric nature of the SVI data distribution, the Kruskal–Wallis test was used for comparisons involving more than two groups, and the Mann–Whitney U test was applied for pairwise analyses. A $p<0.05$ was considered statistically significant.

RESULTS

This study conducted a comprehensive analysis of online information-seeking behaviors related to adalimumab and its brand names using GT data, assessing search volumes over time and by specific keywords. The findings indicate a growing and diversifying public interest in biologic agents.

Among general search queries, the keyword "humira" emerged as the most frequently searched term, reaching a normalized SVI of 100 during most of the study period. In contrast, the generic term "adalimumab" attracted more limited attention (maximum SVI: 24; mean: 10), while "amgevita" appeared only during specific periods (March 2020, December 2021, and March–May 2022). Search queries explicitly related to the indication of uveitis were extremely rare; terms, such as "adalimumab uveitis" and "humira uveitis" showed very low activity over only a few isolated weeks.

Regarding safety concerns, the query "is adalimumab harmful?" demonstrated episodic search interest (maximum SVI: 36), but this pattern was not statistically significant (p=0.468, Kruskal–Wallis test). Meanwhile, searches for "adalimumab side effects," "humira side effects," and "amgevita side effects" remained at a negligible level (SVI=0).

Queries concerning drug efficacy were also scarce. The term "When does Humira work?" appeared with measurable interest only in December 2019 (SVI: 31), while other efficacy-related terms generated no significant search volume.

Regarding administration, only the term "humira pen" attracted notable attention (mean SVI: 16.6; maximum: 86). Other related queries, such as "humira injection," "how to use humira," or "humira dosing schedule," were rarely searched. The interest in "humira pen" remained stable over time (p=0.109, Kruskal–Wallis test).

Cost-related searches were predominantly focused on the term "humira price," which showed significant fluctuations across the years (p=0.0002, Kruskal–Wallis test). Peaks were observed in February 2019, June 2021, and May–July 2022 (maximum SVI: 78). The search term "humira SGK" (referring to reimbursement by the Turkish Social Security Institution) occasionally reflected increased awareness of insurance coverage.

Alternative therapy searches were minimal, with queries, such as "humira or amgevita" (June 2018) and "what can be used instead of humira" (December 2018), appearing in only a few isolated instances (mean SVI: 0.37; maximum: 42).

Searches related to specific clinical scenarios revealed limited public engagement. Terms, such as "humira pregnancy" and "humira vaccine," were never significantly searched throughout the study period. The term "humira in child" showed a peak only once in January 2025 (SVI: 42), while "humira breastfeeding" drew minimal attention in March 2022 (SVI: 28).

Queries reflecting concerns about vision outcomes, such as "humira blindness," "Can Humira restore vision," and "does humira save eyesight," did not yield any meaningful search activity. However, the term "humira and glasses" appeared during three distinct periods: August 2017 (SVI: 44), November 2019 (SVI: 57), and November 2023 (SVI: 33). Despite these spikes, year-by-year comparison revealed no statistically significant differences (p=0.265, Kruskal–Wallis test).

In the theme of patient experiences and satisfaction, only the phrase "are you satisfied with humira?" generated measurable search interest. This query peaked in February 2016, February 2018, and March 2021 (SVI range: 36–40), while remaining minimal at other times (p=0.998, Kruskal–Wallis test).

Regarding administrative and procedural queries, searches related to "humira report" and "how long does humira report last" were minimal. Queries involving tuberculosis and malignancy within the scope of pre-treatment reporting were also rare; only "humira and cancer" was searched during a limited period (September 2016, SVI: 52).

The analysis of the keywords indexed relative to "adalimumab" revealed a cumulative increase in SVI over time (Fig. 1). A comparison of the two time periods – 2016–2020 versus 2021–2025 – revealed a statistically significant increase in search interest in biologic treatments after 2021 (p<0.001, Mann–Whitney U test).

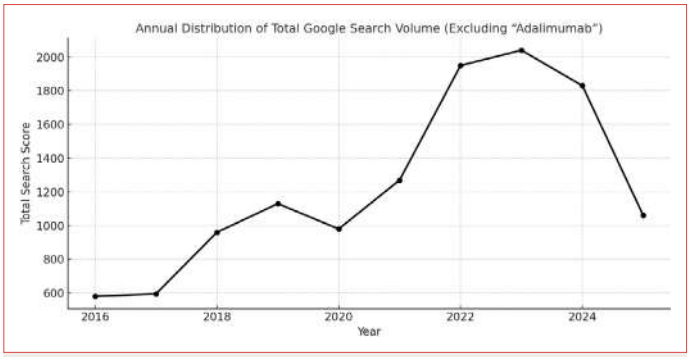


Figure 1. Cumulative annual search volume scores based on Google Trends data from 2016 to 2025, excluding the keyword "adalimumab".

According to the findings of the analysis, presented in Table 2, the search terms that demonstrated the most significant increase in GT data between the periods 2016–2020 and 2021–2025, along with their comparative descriptives, are outlined.

The time-dependent comparison revealed statistically and clinically meaningful increases in the relative search volumes for several keywords between the two periods (2016–2020 vs. 2021–2025). Notably, the phrase "Humira pen" showed the most pronounced increase (mean SVI: 3.60 → 30.78), suggesting a rising public interest in understanding the mode of administration. Similarly, "Humira price" and the general term "Humira" demonstrated a significant increase of 22.48 and 24.20 points, respectively. Furthermore, certain keywords that were previously not searched – such as "Humira in child", "Humira breastfeeding," and "Humira SGK" – began to appear in the latter time period, indicating an emerging public curiosity about special clinical conditions related to adalimumab use.

The geographic distribution of search terms across Turkish provinces was also analyzed based on GT data. "Adalimumab" was searched widely across the country, with the highest SVI values noted in İzmir, Antalya, and Bursa. "Humira" had an even broader geographic reach, being highly searched in Adana, Konya, and Gaziantep, among others. In contrast, interest in the term "Amgevita" was limited to a few provinces, with the highest search volumes observed in İstanbul, Eskişehir, and İzmir.

DISCUSSION

This study aimed to evaluate the online information-seeking behaviors related to adalimumab and its biosimilars in Türkiye, analyzing variations by time, thematic content, and geographic distribution. The findings provide insights into patients' awareness, concerns, and information needs regarding treatment with biologic agents. GT data revealed a significant temporal shift in search behavior, potentially influenced by contextual, regional, and sociocultural dynamics.

A notable increase in search interest related to adalimumab was observed following 2021. This phenomenon can be attributed to the increasing utilization and awareness of the drug. It has been demonstrated by literature that there is a high degree of correlation between the data from the GT and the public's awareness of recently introduced medications.[12] Moreover, the post-2020 period coincides with the emergence of the global Coronavirus Disease 2019 pandemic. During this period, there was a notable surge in the number of individuals seeking digital health information, as patients increasingly

Table 2. Mean SVI values of selected search terms in two distinct time intervals and interpretive remarks

Search term	Mean SVI (2016–2020)	Mean SVI (2021–2025)	Comment
Humira pen administration	3.6	30.8	Substantial rise in interest toward the route of
Humira	55.2	79.4	Increased general awareness and public interest
Humira price	3.1	25.6	Growing concern over economic implications
Amgevita	0.2	6.5	Increased attention to biosimilar alternatives
Humira in child	0.0	0.76	Emerging interest in pediatric indications
Humira SSI	0.0	0.71	Awareness of reimbursement and accessibility issues
Is adalimumab harmful	0.0	0.65	Rising safety concerns over the therapy
Humira injection	0.0	0.53	Seeking information on practical administration
Humira breastfeeding	0.0	0.51	Inquiries related to use during lactation
Humira reviews	0.0	0.09	Demand for patient experience and feedback

SSI: Social Security Institution; SVI: Search Volume Index.

turned to online resources to satisfy their informational needs. Nevertheless, this transition carries with it the potential for the dissemination of misinformation, which may intensify patient anxiety and result in diminished treatment adherence.[13,14] It is therefore imperative for healthcare providers to counsel patients on the reliability of online information sources.

In general search patterns, the brand name "Humira" generated significantly higher interest than the generic term "adalimumab," reaching the maximum normalized SVI during most of the study period. This finding reflects the dominance of brand-based recognition over the active ingredient and highlights public familiarity with commercially promoted content. Similar observations have been made in studies investigating infliximab (Remicade vs. biosimilars).[15] In Türkiye, the relatively lower awareness of "adalimumab" may stem from prescription practices or pharmacist-driven brand recommendations. Meanwhile, interest in the term "Amgevita" – another commercial product – has shown a modest increase but remains geographically limited, likely influenced by market approval timelines and its inclusion in reimbursement schemes (active access in Türkiye began post-2020). Searches for biosimilar alternatives were largely limited to "Humira or Amgevita?", emphasizing the critical role of patient education in treatment transitions involving biosimilars.[16]

The geographical analysis demonstrated that the search term "Amgevita" was predominantly utilized in major metropolitan areas, including Istanbul, Izmir, and Eskişehir. Conversely, "Humira" exhibited a more extensive nationwide interest. This may indicate that recognition of biosimilars is still limited and tends to be concentrated in regions with better healthcare infrastructure. The presence of university hospitals and private clinics, improved access to information, and a more proactive patient population are characteristics of these urban centers. Furthermore, searches for "adalimumab" exhibited a concentration in relatively more socioeconomically developed cities, such as Antalya, Bursa, and Izmir. This finding suggests that users who employ generic search terms may possess a higher level of health literacy and engagement with formal medical terminology.[17]

With regard to the volume of keyword searches, public information-seeking behavior appears to be predominantly focused on cost and safety concerns. However, it was notable that queries related to drug efficacy or pharmacological mechanisms were absent. This finding suggests a lack of pharmacological literacy among the general population. This finding is consistent with the results of previous studies, which indicated that levels of health literacy in Türkiye are limited.[18]

The high search frequency of terms, such as "Humira price" and "Humira SGK" (Social Security Institution) suggests public concern over treatment accessibility. Search peaks in 2019, 2021, and 2022 corresponded to major currency fluctuations and pharmaceutical pricing adjustments in Türkiye. Notably, these periods aligned with public discourse on reimbursement restrictions and policy changes. The temporal overlap implies a public sensitivity to economic access, consistent with previous evidence showing a correlation between online search interest and the cost of anti-cancer drugs,[19] and supports earlier findings that economic factors significantly influence patients' treatment decisions in Türkiye.[20]

Searches related to patient experience, such as "Humira reviews," highlight an increasing demand for patient-centered

care and reflect the public's interest in individual experiences with biologic treatments. Prior literature emphasizes that in chronic conditions requiring biologics, patient experiences and peer feedback can meaningfully influence therapeutic decision-making, independent of clinical evidence.[21-23]

This study has several limitations that should be considered when interpreting the results. First, the analysis was conducted using GT data, which provides normalized SVI on a scale of 0–100, rather than absolute search counts. As a result, search terms with very low volume may appear as "0," potentially underrepresenting niche but clinically relevant queries. This limitation may particularly affect rare or technical terms related to off-label uses, pediatric applications, or disease-specific concerns. In addition, GT does not disclose demographic information, such as users' age, gender, education, or socioeconomic background, limiting the ability to draw conclusions about specific user groups. The intent behind search queries cannot be definitively determined – some may originate from healthcare professionals, caregivers, or students rather than patients. Moreover, the analysis was restricted to Turkish-language searches, which may not capture the behavior of bilingual or non-Turkish-speaking users in Türkiye. Finally, this study does not incorporate data from other digital platforms, such as YouTube, Twitter, or specialized medical forums, which may also significantly contribute to health-related information-seeking behavior.

CONCLUSION

The cumulative findings of this study indicate that public interest in online information about adalimumab and other biologic agents in Türkiye has significantly increased over the years. Searches for the generic name "adalimumab" were more frequent in socioeconomically developed provinces, suggesting that users in these regions may be more familiar with clinical terminology and digital health literacy. In contrast, the more widespread interest in "Humira" illustrates the dominant role of brand awareness in public perception. The emphasis on pricing and patient experience in online searches indicates that patients' decisions are shaped not only by clinical considerations but also by economic and psychosocial factors. The relatively limited public interest in biosimilars further underscores the need for enhanced patient education and awareness campaigns in this area.

DECLARATIONS

Ethics Committee Approval: All data were obtained from the publicly available GT platform; no individual data were collected and therefore no ethics committee approval was required.

Informed Consent: All data was obtained from the publicly available GT platform; no individual data was collected and therefore informed consent was not required.

Conflict of Interest: The authors declare that there is no conflict of interest.

Funding: The authors received no financial support for the research and/or authorship of this article.

Use of AI for Writing Assistance: This study involved generative artificial intelligence (AI)-based language models (ChatGPT, OpenAI) in assisting with the English language editing and academic phrasing of the manuscript text. All data analysis, interpretation, and conclusions were solely conducted and verified by the authors. The AI tool was not used for generating scientific content, nor for performing data analysis.

Authorship Contributions: Concept – BYO; Design – BYO; Supervision – BYO; Fundings – BYO; Materials – BYO, GO; Data collection &/or processing – BYO, GO; Analysis and/or interpretation – BYO; Literature search – BYO, GO; Writing – BYO; Critical review – BYO, GO.

Peer-review: Externally peer-reviewed.

REFERENCES

1. Tsirouki T, Dastiridou A, Symeonidis C, Tounakaki O, Brazitikou I, Kalogeropoulos C, et al. A focus on the epidemiology of uveitis. Ocul Immunol Inflamm 2018;26:2–16.
2. Gaggiano C, Sota J, Gentileschi S, Caggiano V, Grosso S, Tosi GM, et al. The current status of biological treatment for uveitis. Expert Rev Clin Immunol 2020;16:787–811.
3. Hatemi G, Christensen R, Bang D, Bodaghi B, Celik AF, Fortune F, et al. 2018 update of the EULAR recommendations for the management of Behçet's syndrome. Ann Rheum Dis 2018;77:808–18.
4. Jaffe GJ, Dick AD, Brézin AP, Nguyen QD, Thorne JE, Kestelyn P, et al. Adalimumab in patients with active noninfectious uveitis. N Engl J Med 2016;375:932–43.
5. Nguyen QD, Merrill PT, Jaffe GJ, Dick AD, Kurup SK, Sheppard J, et al. Adalimumab for prevention of uveitic flare in patients with inactive non-infectious uveitis controlled by corticosteroids (VISUAL II): a multicentre, double-masked, randomised, placebo-controlled phase 3 trial. Lancet 2016;388:1183–92. Erratum in: Lancet 2016;388:1160.
6. Maniadakis N, Toth E, Schiff M, Wang X, Nassim M, Szegvari B, et al. A targeted literature review examining biologic therapy compliance and persistence in chronic inflammatory diseases to identify the associated unmet needs, driving factors, and consequences. Adv Ther 2018;35:1333–55.
7. Tonsaker T, Bartlett G, Trpkov C. Health information on the Internet: gold mine or minefield? Can Fam Physician 2014;60:407–8.
8. Mavragani A, Ochoa G. Google trends in infodemiology and infoveillance: methodology framework. JMIR Public Health Surveill 2019;5:e13439.

9. Akosman S, Tran E, Rosenberg S, Pakhchanian H, Raiker R, Belyea DA. Patient demand for ophthalmologists in the United States: a google trends analysis. Ophthalmic Epidemiol 2024;31:349–55.
10. Gilson A, Chen Q, Adelman RA. Ophthalmic care may not align with patient need: an analysis on state-wide patient needs and provider density between 2008 and 2022. Int J Med Inform 2024;185:105411.
11. Skrzypczak T, Jany A, Michałowicz J, Hossa M, Bogusławska J, Targonska M. Public interest in cataract surgery: Analysis and implications of google trends data from 14 European countries. Ophthalmic Epidemiol 2022;29:108–15.
12. Berning P, Schroer AE, Adhikari R, Razavi AC, Cornelis FH, Erinjeri JP, et al. Online searches for hepatocellular carcinoma drugs mirror prescription trends across specialties and changes in guideline recommendations. Front Oncol 2024;14:1324095.
13. Eysenbach G. Infodemiology: the epidemiology of (mis)information. Am J Med 2002;113:763–5.
14. Wang Y, McKee M, Torbica A, Stuckler D. Systematic literature review on the spread of health-related misinformation on social media. Soc Sci Med 2019;240:112552.
15. Du X, Luo X, Guo Q, Jiang X, Su Z, Zhou W, et al. Assessment of clinical benefit, cost and uptake of biosimilars versus reference biologics in immune-mediated inflammatory diseases in China. Front Public Health 2024;12:1476213.
16. Bruni C, Gentileschi S, Pacini G, Bardelli M, Tofani L, Bartoli F, et al. Switching from originator adalimumab to biosimilar SB5 in a rheumatology cohort: persistence on treatment, predictors of drug interruption and safety analysis. Ther Adv Musculoskelet Dis 2021;13:1759720X211033679.
17. Nutbeam D. The evolving concept of health literacy. Soc Sci Med 2008;67:2072–8.
18. Ozdemir H, Alper Z, Uncu Y, Bilgel N. Health literacy among adults: a study from Turkey. Health Educ Res 2010;25:464–77.
19. Zhang J, Hu S, Liu X, Liu X, Zhang J, Yang C, et al. Time trends and regional variations in prices of anticancer medicines in China. Front Pharmacol 2024;15:1397784
20. Atun R, Aydın S, Chakraborty S, Sümer S, Aran M, Gürol I, et al. Universal health coverage in Turkey: enhancement of equity. Lancet 2013;382:65–99.
21. Lee SY, Hawkins R. Why do patients seek an alternative channel? The effects of unmet needs on patients' health-related Internet use. J Health Commun 2010;15:152–66.
22. Ziebland S, Wyke S. Health and illness in a connected world: how might sharing experiences on the internet affect people's health? Milbank Q 2012;90:219–49
23. Ziebland S, Powell J, Briggs P, Jenkinson C, Wyke S, Sillence E, et al. Examining the role of patients' experiences as a resource for choice and decision-making in health care: a creative, interdisciplinary mixed-method study in digital health. Southampton (UK): NIHR Journals Library; 2016.

Supplementary Data

Anahtar kelimeler*	Genel bilgi	Güvenlik	Etkinlik	Uygulama	Ücret	Karşılaştırma	Özel durumlar	Görme üzerine	Hasta memnuniyeti	Rapor prosedürü
Referans†	Adalimumab (ADA)‡	ADA	ADA	ADA	ADA	ADA	ADA	ADA	ADA	ADA
A1	Humira§	Humira yan etki	Humira işe yarıyor mu	Humira nasıl kullanılır:	Humira fiyat	Humira alternatifi	Humira gebelik	Humira körlük	Humira nasıl bir ilaç	Humira raporu
A2	Amgevita	Amgevita yan etki	Humira faydası	Humira kaç günde bir yapılır	Amgevita fiyat	Humira mı amgevita mı	Humira çocuk	Humira görme düzelir mi	Humira yorumlar	Humira rapor kaç ay
A3	ADA üveit	ADA yan etki	Humira etkili mi	Humira enjeksiyon	Humira sgk	Humira yerine ne kullanılır	Humira aşı	Humira göz kurtulur mu	Humira kullananlar ne diyor:	Humira verem
A4	Humira üveit	ADA zararlı mı	Humira ne zaman etki eder	Humira pen	Humira geri ödeme	Humira mı kortizon mu	Humira emzirme	Humira gözlük	Amgevita kullannalar ne diyor	Humira kanser

A: Anahtar kelime; ADA: Adalimumab; SGK: Sosyal güvenlik kurumu. *Anahtar kelimeler denenerek halk dilinde en olası söz öbekleri seçilerek belirlenmiştir. †Kıyaslama sağlamak için "Adalimumab" sabit tutulmuştur. ‡Arama yapılırken "Adalimumab" şeklinde açık hali yazılmıştır. ADA kısaltması grafik için yapılmıştır. §En sık aranan terim "Humira" olduğu için diğer gruplarda terim olarak "Humira" tercih edilmiştir.

ORIGINAL ARTICLE

European Archives of Medical Research

DOI: 10.14744/eamr.2025.85698
Eur Arch Med Res 2025;41(4):222–228

Vertical Midvastus Incision Enhances Early Recovery in Total Knee Arthroplasty

Serhat Gurbuz, Hakan Bahar

Department of Orthopedics and Traumatology, Baltalimanı Bone Diseases Training and Research Hospital, İstanbul, Türkiye

ABSTRACT

Objective: The midvastus arthrotomy technique is commonly utilized in total knee arthroplasty (TKA) due to its potential to preserve quadriceps integrity and improve early post-operative outcomes. This retrospective cohort study evaluates the impact of incision orientation in the midvastus technique on pain, functional recovery, and surgical outcomes.

Materials and Methods: A total of 90 patients undergoing TKA were included, divided into three groups: standard midline, horizontally oriented, and vertically oriented midvastus incisions. All patients received the same implant and standardized perioperative care. Outcomes such as pain (VAS), function, blood transfusion rates, and numbness were assessed at 10 days, 1 month, and 3 months.

Results: The vertical incision group demonstrated significantly lower VAS scores and faster functional recovery. Blood transfusion rates and numbness incidence were also lowest in this group. Results are supported by p-values and descriptive statistics.

Conclusion: Vertical incision orientation in the midvastus approach appears to offer benefits in early post-operative outcomes. Following primary TKA, the vertical modified midvastus approach appears to be appropriate for enhancing early post-operative comfort.

Keywords: Arthroplasty, Knee, Quadriceps muscle

Cite this article as: Gurbuz S, Bahar H. Vertical Midvastus Incision Enhances Early Recovery in Total Knee Arthroplasty. Eur Arch Med Res 2025;41(4):222–228.

INTRODUCTION

The choice of arthrotomy technique in total knee arthroplasty (TKA) plays a critical role in surgical outcomes, affecting both intraoperative exposure and post-operative recovery.[1,2] The most commonly employed techniques include the medial parapatellar, subvastus, and midvastus arthrotomies.[3] Each method has distinct advantages and limitations, and the selection is often determined by patient anatomy, surgeon preference, and the specific procedural requirements.

The medial parapatellar approach remains the gold standard for many surgeons, providing excellent exposure to the knee joint by laterally displacing the patella.[4] However, transection of the quadriceps tendon is required, which can lead to post-operative quadriceps weakness, delayed rehabilitation, and increased early post-operative pain.[5]

Address for correspondence: Serhat Gurbuz. Department of Orthopedics and Traumatology, Baltalimanı Bone Diseases Training and Research Hospital, İstanbul, Türkiye

E-mail: gurbuzserhat@outlook.com **ORCID ID:** 0000-0002-6120-3325

Submitted: 29.04.2025 **Revised:** 15.08.2025 **Accepted:** 26.08.2025 **Available Online:** 20.10.2025

European Archives of Medical Research – Available online at www.eurarchmedres.org

To minimize the impact on the quadriceps mechanism, less invasive techniques such as the subvastus and midvastus approaches have been developed.[6,7] The subvastus approach, which retracts the vastus medialis without cutting the quadriceps tendon, preserves muscle integrity and has been associated with reduced post-operative pain and faster recovery.[8] Nevertheless, it is technically demanding and may limit visualization, particularly in obese patients or those with complex deformities.

The midvastus approach was introduced to combine the exposure benefits of the medial parapatellar technique with the muscle-sparing advantages of the subvastus approach.[9] In this method, the arthrotomy is performed through the fibers of the vastus medialis, preserving the quadriceps tendon while maintaining adequate exposure. Clinical studies have shown that the midvastus technique results in less post-operative pain, faster quadriceps strength recovery, and improved early functional outcomes compared with the medial parapatellar approach.[10] Furthermore, patients often report higher satisfaction and a quicker return to daily activities.

Despite numerous publications on the midvastus approach, a standardized definition of the incision orientation is lacking. Most descriptions are vague, commonly referring only to an incision "parallel to the fibers."[11] This lack of precision may contribute to variability in surgical performance and outcomes. Therefore, the objective of this study is to define the optimal incision orientation for midvastus arthrotomy, with a focus on angles that enhance surgical performance and precision. The hypothesis is that a vertical incision modification of the midvastus technique provides superior clinical and functional outcomes compared to the conventional description.

Table 1. Study population

Inclusion criteria	Exclusion criteria
Age 55–75	Rheumatologic diseases
No previous surgery on the same side	History of previous surgery on the ipsilateral knee
General anesthesia	Vascular disorders or history of thrombotic events
Bilateral cases	Tibiofemoral angle >30°

MATERIALS AND METHODS

This retrospective study was approved by the institutional review board of Metin Sabancı Baltalimanı Bone Diseases Training and Research Hospital (approval number: 22-147, dated May 30, 2024) and was conducted in accordance with the ethical principles of the Declaration of Helsinki. All data were collected from hospital records following established ethical standards. The study population consisted of 90 patients who underwent TKA using the midvastus arthrotomy technique by the same surgical team at our institution between August 2022 and February 2024.

Inclusion criteria were patients aged 55–75 years with primary varus gonarthrosis and no prior surgery on the ipsilateral knee. Patients were excluded if they had rheumatologic diseases, previous ipsilateral knee surgery, vascular disorders or thrombotic events, did not receive general anesthesia, or had a tibiofemoral angle >30°. Only patients classified as the American Society of Anesthesiologists physical status I or II were included (Table 1).

All 90 patients (100%) completed the 3-month post-operative follow-up, with no losses to follow-up. Baseline demographic and clinical characteristics – including age, sex, body mass index, hypertension, and diabetes mellitus – were similar among the groups, with no statistically significant differences (all $p>0.05$; Table 2).

Patients were assigned to three groups (n=30 each) according to hospital admission order, each receiving a different midvastus arthrotomy incision orientation: vertical, midline, or horizontal. In all cases, the same type of cemented, posterior-stabilized knee prosthesis was implanted (Trausson, Stryker, USA). Standardized perioperative protocols – including general anesthesia, post-operative analgesia, and rehabilitation–were uniformly applied. All surgeries were performed under tourniquet control. Tranexamic acid was administered locally at wound closure to minimize bleeding.

Table 2. Patient demographics

Group	Age (mean±SD)	Male (%)	BMI (mean±SD)	Hypertension (%)	Diabetes (%)
Group 1	66.9±6.3	36.67	29.6±3.3	43.3	30
Group 2	67.2±6.1	40	29.8±3.5	43.3	30
Group 3	66.5±5.9	43.3	30.1±3.7	46.6	33.3

BMI: Body mass index; SD: Standard deviation.

Patients were mobilized starting on the 1st post-operative day. Pain management during the early post-operative period consisted of intravenous paracetamol and tramadol as needed, with opioid-based intravenous analgesics available. Rehabilitation focused on quadriceps strengthening exercises supervised by a physiotherapist. Patients were encouraged to attend follow-up visits accompanied by their physiotherapist to ensure continuity of care.

The first group underwent TKA with a vertically oriented midvastus arthrotomy, involving a laterally placed incision at a steep angle (60–75°) to potentially improve joint access while preserving quadriceps integrity (Fig. 1). The second group had a midline incision through approximately the midline fibers of the vastus medialis muscle at 30–45°, preserving the quadriceps tendon and providing sufficient exposure (Fig. 2). The third group received a more medial, transverse incision (10–20°) through the vastus medialis muscle belly, more horizontal than the midline approach but still intramuscular and distinct from the subvastus technique (Figs. 3 and 4).

The primary outcomes were post-operative pain, assessed with the Visual Analog Scale (VAS), and functional recovery, measured by the Oxford Knee Score (OKS) at 10 days, 1 month, and 3 months postoperatively during rest. All patients completed assessments at each time point, ensuring 100% follow-up compliance. Secondary outcomes included intraoperative blood loss, transfusion requirements, and wound complication rates. Outcome measures were independently evaluated by two blinded clinicians unaware of the arthrotomy incision type. The interobserver reliability was high, with an intraclass correlation coefficient of 0.95.

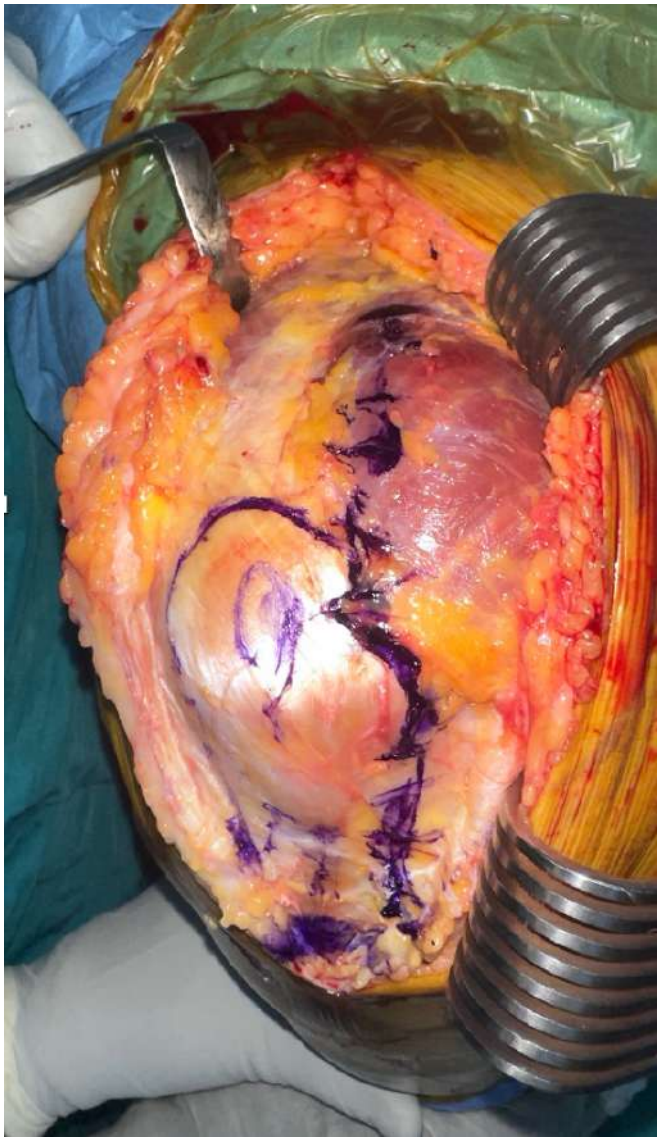


Figure 1. Vertically incised midvastus arthrotomy.

Figure 2. Midline incised midvastus arthrotomy.

Figure 3. Horizontally incised midvastus arthrotomy.

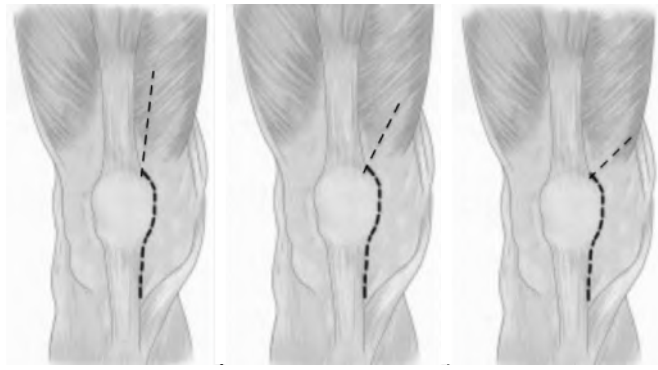


Figure 4. All 3 different incision angles demonstrated; vertical, midline and horizontal.

Statistical Analysis

Data analysis was performed using IBM Statistical Package for the Social Sciences (SPSS) Statistics version 24 (SPSS Inc., Chicago, IL, USA). Statistical significance was set at $p<0.05$. A post hoc power analysis was conducted with G*Power software to confirm the adequacy of the sample size.[12] For a one-way Analysis of Variance (ANOVA) with three groups, an alpha of 0.05, and desired power of 0.80, a sample size of 30 patients per group (total n=90) was sufficient to detect a medium effect size (Cohen's f=0.24), confirming the study's robustness. Comparisons of continuous variables among the three groups were made using one-way ANOVA, with Bonferroni correction applied for multiple pairwise comparisons. Categorical variables were compared using Chi-square tests.

RESULTS

The post-operative outcomes of the three patient groups were analyzed to identify significant differences in blood transfusion rates, OKSs, VAS pain scores, and incidence of numbness.

Functional outcomes (OKS): Significant intergroup differences were observed at all post-operative time points. On day 10, mean±standard deviation (SD) OKS scores were 34.5±5.4 for Group 1, 28.3±4.6 for Group 2, and 32.1±5.0 for Group 3 (η^2=0.24). The 95% confidence interval (CI) for the difference between Group 2 and Group 3 ranged from –5.9 to –1.4, with a Cohen's d effect size of 0.88. This pattern persisted at 1 month (Group 1: 39.1±5.6, Group 2: 34.2±5.1, Group 3: 37.8±5.3; η^2=0.11) and 3 months (Group 1: 43.0±5.4, Group 2: 38.9±4.9, Group 3: 41.5±5.2; η^2=0.10), with Group 2 consistently showing lower scores (Table 2).

Post hoc analyses revealed significant differences in blood transfusion rates between Group 2 and Group 3 (mean difference=0.50, p=0.013) and between Group 1 and Group 2 (mean difference=0.58, p=0.002). No significant difference was found between Groups 1 and 3. Regarding OKS, significant differences were found at day 10 between Group 2 and Group 3 (p=0.002) and between Group 1 and Group 2 ($p<0.05$), while no significant difference was observed between Groups 1 and 3. At 1 and 3 months, significant differences persisted only between Group 2 and Group 3 ($p<0.05$), with no significant differences between other group comparisons (Table 2).

Post-operative pain (VAS scores): Significant differences were observed among groups at all evaluated time points. On day 10, mean±SD VAS scores were 2.8±0.9 (Group 1), 4.8±1.1 (Group 2), and 3.6±1.0 (Group 3) (one-way Analysis of Variance η2=0.38). The 95% CI for the difference between Groups 1 and 2 was –2.4 to –1.2, with a large effect size (Cohen's d=1.94). Similar trends were maintained at 1 month (2.1±0.8, 3.9±1.2, 2.9±1.1; η2=0.29, d=1.66 between Groups 1 and 2) and at 3 months (1.5±0.7, 2.7±1.0, 2.1±0.9; η2=0.14, d=1.34 between Groups 1 and 2) (Table 3).

Blood transfusion and numbness rates: Blood transfusions were required in 3/30 patients (10%) in Group 1, 9/30 (30%)

Table 3. Post-operative pain and functional outcome scores

Time point	Group 1 (mean±SD)	Group 2 (mean±SD)	Group 3 (mean±SD)	p
VAS 10 d	2.8±0.9	4.8±1.1	3.6±1.0	<0.01*
VAS 1 m	2.1±0.8	3.9±1.2	2.9±1.1	0.014*
VAS 3 m	1.5±0.7	2.7±1.0	2.1±0.9	0.048*
OKS 10 d	34.5±5.4	28.3±4.6	32.1±5.0	<0.01*
OKS 1 m	39.1±5.6	34.2±5.1	37.8±5.3	0.016*
OKS 3 m	43.0±5.4	38.9±4.9	41.5±5.2	0.012*

VAS: Visual analogue score; OKS: Oxford knee score; SD: Standard deviation.

in Group 2, and 6/30 (20%) in Group 3, showing a significant difference among groups (p=0.007, Cramér's V=0.33). Post-operative numbness occurred in 2/30 (6.7%), 5/30 (16.6%), and 4/30 (13.3%) patients in Groups 1, 2, and 3, respectively (p=0.002, Cramér's V=0.31) (Table 4).

In summary, Group 2 generally demonstrated worse functional outcomes, higher pain scores, and increased blood transfusion and numbness rates compared to Groups 1 and 3.

DISCUSSION

This study demonstrated that the vertically oriented midvastus arthrotomy technique offers significant advantages over both the classic midline approach and the horizontal modification, particularly regarding post-operative pain, functional outcomes, and the need for blood transfusion.

A key finding was the significant reduction in blood transfusion rates in Group 1. This technique likely reduces intraoperative trauma and bleeding, aligning with previous literature while adding new clinical insights into the benefits of the midvastus approach.[13,14] Muscles are highly vascularized tissues–more so than tendons in the lower extremity–and the midvastus approach involves incision through the vastus medialis obliquus (VMO) muscle belly.[15] Our results suggest that vertically oriented incisions may reduce bleeding, potentially due to anatomical factors such as the vascularization pattern of the medial superior genicular artery, a branch of the popliteal artery.[14] Vertical incisions may therefore anatomically distance the incision from critical vascular structures, contributing to lower perioperative blood transfusion rates.[13] In addition, midline incisions often cause more extensive muscle disruption, whereas Group 1's average incision length was shorter, particularly compared to Group 3, likely sparing more muscle tissue.

Table 4. Post-operative blood loss and nerve injury rates

Group	Blood transfusion (%)	Reported numbness (%)
Group 1	10	6.67
Group 2	30	16.6
Group 3	20	13.3

Regarding post-operative pain, Group 1 consistently exhibited significantly lower VAS scores at multiple time points, especially at day 10 and 1 month. These findings support previous evidence linking less invasive arthrotomy techniques to reduced post-operative pain.[16] Although this study did not compare the midvastus approach with other arthrotomy techniques, all patients had intact patellar tendons, indicating that the improved outcomes in Group 1 may be attributable to decreased muscle damage and a shorter incision length. Furthermore, all patellae were everted for optimal joint visualization, and the vertically oriented technique seems to further enhance pain management, highlighting the importance of incision angle and muscle preservation.

The horizontal midvastus approach resembles the subvastus technique, while the vertical modification is more akin to the paramedian parapatellar approach. Our study integrated elements from both approaches in the midvastus technique to determine an optimal incision angle. Future research should compare these modifications directly to the original subvastus and paramedian parapatellar techniques for more definitive conclusions.

Functional recovery, measured by the OKS, was faster in Group 1, with statistically significant improvements at days 10, 1 month, and 3 months postoperatively. These results align with growing evidence that muscle-sparing techniques, especially those avoiding direct quadriceps tendon damage, facilitate quicker functional recovery.[17,18] While the midvastus approach has been shown to improve early outcomes compared to the medial parapatellar technique, literature on the modified midvastus approach is scarce, and prior descriptions lack precision—typically noting only that the incision is "parallel to

the muscle fibers." Our findings emphasize the significance of incision orientation and surgical technique modification for optimizing early recovery.

Long-term implications of early functional differences are also relevant. Although our follow-up was limited to 3 months, longer studies have shown that early functional gains often predict better long-term outcomes.[3] Patients recovering faster initially tend to maintain improved function and satisfaction at 1- and 2-year follow-ups.[19,20] This suggests the potential for sustained benefits from the vertically oriented technique, though further long-term studies are necessary. Notably, some reports demonstrate better early outcomes but similar long-term results among techniques.[2,21,22]

Another secondary outcome was the incidence of post-operative numbness, which can affect patient satisfaction but is often underreported. We found a significantly lower rate of numbness in the vertically modified midvastus group. This finding is consistent with prior studies reporting fewer sensory deficits with quadriceps-sparing TKA techniques,[23] further supporting the soft-tissue preservation benefits of refined midvastus modifications.

Despite standardized surgical and rehabilitation protocols, this study has limitations. The relatively short follow-up limits assessment of long-term outcomes and complications such as prosthetic loosening or wear. The single-center, retrospective design may restrict generalizability, warranting larger multicenter prospective studies. In addition, we did not account for individual anatomical variability in VMO fiber orientation, and no intraoperative imaging was performed to verify incision alignment with muscle fibers. Hemoglobin data indicated greater perioperative blood loss in Group 2, corroborating transfusion rates and suggesting that incision orientation influences tissue handling and bleeding. Functional assessments, such as quadriceps strength and patellar tracking, were not evaluated but are important for future research.

CONCLUSION

This retrospective study offers valuable insights into the comparative outcomes of three midvastus arthrotomy techniques in TKA. The vertically oriented incision was associated with reduced pain, lower transfusion rates, and faster functional recovery. These results highlight the importance of tailoring incision angles based on anatomical fiber direction. Prospective, anatomically guided studies with extended follow-up are needed to confirm and refine these preliminary findings.

DECLARATIONS

Ethics Committee Approval: The study was approved by Metin Sabancı Baltalimanı Bone Diseases Training and Research Hospital Ethics Committee (No: 22-147, Date: 30/05/2024).

Conflict of Interest: The authors declare that there is no conflict of interest.

Funding: The authors received no financial support for the research and/or authorship of this article.

Use of AI for Writing Assistance: Not used.

Authorship Contributions: Concept – SG; Design – SG; Supervision – HB; Fundings – HB; Materials – SG, HB; Data collection &/or processing – SG; Analysis and/or interpretation – SG; Literature search – SG; Writing – SG; Critical review – HB.

Peer-review: Externally peer-reviewed.

REFERENCES

1. Stubnya BG, Kocsis K, Váncsa S, Kovács K, Agócs G, Stubnya MP, et al. Subvastus approach supporting fast-track total knee arthroplasty over the medial parapatellar approach: a systematic review and network meta-analysis. J Arthroplasty 2023;38:2750–8.
2. C Katragadda B, Kumar S, Suresh A, Vk K. Midvastus versus medial parapatellar approach in simultaneous bilateral total knee arthroplasty. J Arthroplasty 2023;38:2301–6.
3. Bouché PA, Corsia S, Nizard R, Resche-Rigon M. Comparative efficacy of the different surgical approaches in total knee arthroplasty: a systematic-review and network meta-analysis. J Arthroplasty 2021;36:1187–94.e1.
4. Harwin SF. The medial parapatellar approach to the knee. J Knee Surg 2003;16:43–7.
5. Khan MNH, Abbas K, Faraz A, Ilyas MW, Shafique H, Jamshed MH, et al. Total knee replacement: a comparison of the subvastus and medial parapatellar approaches. Ann Med Surg (Lond) 2021;68:102670.
6. Maestro A, Suarez MA, Rodriguez L, Guerra C, Murcia A. The midvastus surgical approach in total knee arthroplasty. Int Orthop 2000;24:104–7.
7. Geng L, Fu J, Xu C, Ren P, Wang YM, Ji QB, et al. The comparison between mini-subvastus approach and medial parapatellar approach in TKA: a prospective double-blinded randomized controlled trial. Orthop Surg 2022;14:2878–87.
8. Wu Y, Zeng Y, Bao X, Xiong H, Hu Q, Li M, et al. Comparison of mini-subvastus approach versus medial parapatellar approach in primary total knee arthroplasty. Int J Surg 2018;57:15–21.
9. Engh GA, Ammeen DJ. The midvastus approach to the knee. J Knee Surg 2003;16:48–51.
10. Liu HW, Gu WD, Xu NW, Sun JY. Surgical approaches in total knee arthroplasty: a meta-analysis comparing the midvastus and subvastus to the medial peripatellar approach. J Arthroplasty 2014;29:2298–304.

11. Engh GA, Parks NL. Surgical technique of the midvastus arthrotomy. Clin Orthop Relat Res 1998;270–4.
12. Kang H. Sample size determination and power analysis using the G*Power software. J Educ Eval Health Prof 2021;18:17.
13. Cooper RE Jr, Trinidad G, Buck WR. Midvastus approach in total knee arthroplasty: a description and a cadaveric study determining the distance of the popliteal artery from the patellar margin of the incision. J Arthroplasty 1999;14:505–8.
14. Björkström S, Goldie IF. A study of the arterial supply of the patella in the normal state, in chondromalacia patellae and in osteoarthrosis. Acta Orthop Scand 1980;51:63–70.
15. Vasiliadis AV, Chatziravdeli V, Metaxiotis D, Beletsiotis A. A prospective randomized comparative study between midvastus and standard medial parapatellar approaches for total knee replacement regarding the peri-operative factors. Cureus 2022;14:e29889.
16. Haas SB, Cook S, Beksac B. Minimally invasive total knee replacement through a mini midvastus approach: a comparative study. Clin Orthop Relat Res 2004;68–73.
17. Karachalios T, Giotikas D, Roidis N, Poultsides L, Bargiotas K, Malizos KN. Total knee replacement performed with either a mini-midvastus or a standard approach: a prospective randomised clinical and radiological trial. J Bone Joint Surg Br 2008;90:584–91.
18. Nikodelis T, Grigoriadis S, Metaxiotis D, Mylonas V, Kellis E. Mid-vastus approach induces milder short-term effects on postural control compared to parapatellar approach in total knee arthroplasty. Clin Biomech (Bristol) 2024;120:106354.
19. Blom AW, Hunt LP, Matharu GS, Reed M, Whitehouse MR. The effect of surgical approach in total knee replacement on outcomes. An analysis of 875,166 elective operations from the National Joint Registry for England, Wales, Northern Ireland and the Isle of Man. Knee 2021;31:144–57.
20. Yang X, Cheng QH, Yang YZ, Zhang AR, Fan H, Guo HZ. Minimally invasive medial femoral approach to total knee arthroplasty improves short-term outcomes compared to the standard medial parapatellar approach: a systematic review and meta-analysis. J Orthop Surg Res 2023;18:657.
21. Sogbein OA, Zomar BO, Bryant DM, Howard JL, Marsh JD, Lanting BA. Effects of surgical approach and tourniquet use on patient-reported outcomes following total knee arthroplasty: a pilot randomized clinical trial. Orthop Res Rev 2022;14:407–17.
22. Lechner R, Lazzeri M, Oberaigner W, Nardelli P, Roth T, Köglberger P, et al. Does the type of surgical approach affect the clinical outcome of total knee arthroplasty? Orthopade 2021;50:674–80.
23. Holt G, Nunn T, Allen RA, Forrester AW, Gregori A. Variation of the vastus medialis obliquus insertion and its relevance to minimally invasive total knee arthroplasty. J Arthroplasty 2008;23:600–4.

ORIGINAL ARTICLE

European Archives of Medical Research

DOI: 10.14744/eamr.2025.09327
Eur Arch Med Res 2025;41(4):229–234

Stress, Anxiety, and Work-Related Distress Among Medical Residents: A Comparative Analysis of Anesthesiology and Internal Medicine Residents

Abdurrahman Tunay, Sevim Baltali, Gul Cakmak, Ozlem Atesal, Meryem Ozyolcu

Department of Anesthesiology and Reanimation, Health Sciences University Istanbul Training and Research Hospital, Istanbul, Türkiye

ABSTRACT

Objective: The field of anesthesiology and reanimation is particularly suited for investigating the relationship between work-related stress and anxiety due to the high demands it places on managing these psychological states. For residents newly exposed to the rigorous working conditions of anesthesiology, the clinical environment can be psychologically challenging. This study was designed based on the hypothesis that anesthesia and reanimation residents, due to their higher exposure to emergency situations and more intense workloads, may exhibit higher levels of stress, anxiety, and distress compared to internal medicine residents.

Materials and Methods: Between April 21 and July 6, 2025, a total of 50 medical residents were enrolled in this study from the Departments of Anesthesiology and Reanimation and Internal Medicine at a tertiary education and research hospital. Each participant completed the Visual Analog Scale (VAS), State-Trait Anxiety Inventory (STAI-I and STAI-II), Perceived Stress Scale (PSS-10), and Penn State Worry Questionnaire (PSWQ) during a 24-hour shift. Residents with known cardiovascular or psychiatric disorders were excluded from the study.

Results: Regarding psychological assessments, no significant differences were found between the groups for PSS-10 scores. Similarly, PSWQ scores did not differ significantly. VAS scores for anxiety measured before and after shifts showed no significant difference between groups. There was no statistically significant correlation between years of residency and scores on the PSS-10, PSWQ, STAI-I, STAI-II, pre-shift VAS, and post-shift VAS scales. The observed correlation coefficients were weak and negative in direction. The strongest negative correlation was found between years of residency and the PSS-10 score, though this was not statistically significant. These findings suggest that as residency seniority increases, there is no notable change in levels of stress, worry, or anxiety.

Conclusion: This study highlights that both anesthesiology and internal medicine residents experience high levels of anxiety, stress, and pathological worry associated with 24-hour shift work, regardless of differences in specialty or seniority.

Keywords: Anxiety, Resident, Stress

Cite this article as: Tunay A, Baltali S, Cakmak G, Atesal O, Ozyolcu M. Stress, Anxiety, and Work-Related Distress Among Medical Residents: A Comparative Analysis of Anesthesiology and Internal Medicine Residents. Eur Arch Med Res 2025;41(4):229–234.

Address for correspondence: Abdurrahman Tunay. Department of Anesthesiology and Reanimation, Health Sciences University Istanbul Training and Research Hospital, Istanbul, Türkiye

E-mail: atunay.02@hotmail.com **ORCID ID:** 0000-0001-7118-9312

Submitted: 11.08.2025 **Revised:** 15.08.2025 **Accepted:** 15.08.2025 **Available Online:** 20.10.2025

European Archives of Medical Research – Available online at www.eurarchmedres.org

INTRODUCTION

The field of anesthesiology and reanimation is particularly suited for investigating the relationship between work-related stress and anxiety due to the high demands it places on managing these psychological states.[1] For residents who are newly exposed to the rigorous working conditions of anesthesiology, the clinical environment can be psychologically challenging.[1] Among anesthesia residents, stress and anxiety are commonly observed, largely due to responsibilities such as ensuring patient safety and managing unexpected emergencies.[2] Although internal medicine residents also work under demanding conditions, they are comparatively less frequently exposed to acute, life-threatening situations.

While the medical specialty in which a healthcare professional works does not significantly influence the intensity of stress symptoms, it has been shown to play a specific role in the severity of anxiety symptoms.[3] Stress is defined as a physiological response triggered by the perception of a threat. This response is often accompanied by emotional reactions in which anxiety emerges as a dominant and persistent feeling.[4] Anxiety is generally categorized into two types: state anxiety, which refers to a temporary and acute response to perceived threats, and trait anxiety, which reflects a stable tendency to experience anxiety and is closely associated with personality traits.[5]

The increase in anxiety levels among physicians is considered to be multifactorial. Elevated anxiety not only affects the psychological and physical well-being of physicians but can also impair job performance, increase the risk of medical errors, and reduce patient satisfaction.[6]

This study was designed based on the hypothesis that anesthesia and reanimation residents, due to their higher exposure to emergency situations and more intense workloads, may exhibit higher levels of stress, anxiety, and distress compared to internal medicine residents. The primary aim of this study is to assess the impact of work-related factors on stress, anxiety, and distress levels among anesthesiology and internal medicine residents during 24-hour shifts. The secondary aim is to provide recommendations for mitigating the risks of stress, anxiety, and psychological distress associated with prolonged work hours.

MATERIALS AND METHODS

Study Design and Participants

Between April 21 and July 6, 2025, a total of 50 medical residents were enrolled in this study from the Departments of Anesthesiology and Reanimation and Internal Medicine at a tertiary education and research hospital. This study was initiated following the approval of the Ethics Committee of the local hospital, dated April 18, 2025, and numbered 94, and adhered to the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants. The sample included 25 residents from each department, with representation from each year of residency training, ranging from the first to fifth year.

Each participant completed the designated psychological assessments at the beginning and end of a 24-hour shift. Residents with known cardiovascular or psychiatric disorders were excluded from the study.

Data Collection and Assessment Tools

All residents who participated in the study worked 24-hour shifts at a frequency of once every three days or less throughout the study period. The participants completed validated self-report questionnaires assessing anxiety, stress, and pathological worry.

The following standardized assessment tools were used:

1. **Anxiety Assessment:**

- **Visual Analog Scale (VAS):** Administered at the beginning and end of each 24-hour shift to evaluate subjective anxiety levels. A VAS score of ≥5 was considered indicative of significant anxiety.
- **State-Trait Anxiety Inventory (STAI-I and STAI-II):** Administered only at the beginning of the 24-hour shift. STAI-I measured state anxiety (cut-off ≥40), while STAI-II assessed trait anxiety (cut-off ≥44).[7]

2. **Stress Assessment:**

- **Perceived Stress Scale (PSS-10):** Applied prior to the shift to evaluate perceived stress levels during the past month. A score of ≥14 was used as the threshold for significant stress.[8]

3. **Pathological Worry Assessment:**

- **Penn State Worry Questionnaire (PSWQ):** Administered prior to the 24-hour shift to assess levels of pathological worry. A score of ≥40 was considered indicative of clinically significant worry.[9]

Statistical Analysis

Descriptive statistics were presented as mean, standard deviation, median, minimum, maximum, frequency, and percentage values. The distribution of continuous variables was assessed using the Kolmogorov–Smirnov and Shapiro–Wilk tests. For the analysis of independent quantitative variables: if normally distributed, the Independent Samples t-test was used; if not normally distributed, the Mann–Whitney U test was applied. Categorical (qualitative) variables

were analyzed using the Chi-square test. To assess correlations between variables, the Spearman correlation analysis was performed. All statistical analyses were conducted using IBM SPSS Statistics for Windows, Version 27.0 (IBM Corp., Armonk, NY, USA).

Sample Size and Power Analysis

In this observational pre-test/post-test (before–after) study involving 50 participants with paired measurements and a 1:1 group ratio, the statistical power was calculated to be 92% (1–β=0.92), assuming a significance level (α=0.05) and an effect size (Cohen's d=0.75).

RESULTS

Participant Characteristics

Among the 50 residents included in the study, 27 (54%) were female and 23 (46%) were male. None of the participants reported any comorbid medical conditions. Twelve residents (24%) were in their first year of training, 8 (16%) in the second year, 13 (26%) in the third year, 8 (16%) in the fourth year, and 9 (18%) in the fifth year of residency (Table 1).

Regarding psychological assessments, the PSS-10 scores ranged from 9 to 33, with a median of 20 and a mean±SD of 20.4±5.7; 88% of participants scored ≥14, indicating high perceived stress levels. The PSWQ scores varied between 23 and 72, with a median of 45.5 and mean±SD of 46.6±11.6; 70% scored above the pathological worry cutoff (≥40). STAI-I scores ranged from 20 to 80 (median: 42.5; mean±SD: 43.4±12.5), with 56% scoring ≥40. STAI-II scores ranged from 20 to 68 (median: 43.5; mean±SD: 43.1±10.2), with 68% scoring ≥44. VAS scores for anxiety before shifts ranged from 0 to 8 (median: 3.0; mean±SD: 3.4±2.0), with 26.0% scoring ≥5. Post-shift VAS scores ranged from 0 to 7 (median: 4.0; mean±SD: 4.2±2.0), with 50% scoring ≥5 (Table 1).

Comparison Between Internal Medicine and Anesthesiology Groups

There was no statistically significant difference between the Internal Medicine and Anesthesiology groups in terms of gender distribution (female: 52.0% vs. 56.0%, p=0.777). However, seniority differed significantly between groups (p=0.021), with a higher proportion of senior residents in the Anesthesiology group compared to Internal Medicine (Table 2).

Regarding psychological assessments, no significant differences were found between the groups for PSS-10 scores (Internal Medicine: 21.0±5.8 vs. Anesthesiology: 19.9±5.7; p=0.494), with 88.0% of participants in both groups scoring above the cutoff (≥14). Similarly, PSWQ scores did not differ significantly (47.4±11.7 vs. 45.7±11.7; p=0.614), with pathological worry (≥40) observed in 72.0% and 68.0% of participants in the Internal Medicine and Anesthesiology groups, respectively (Table 2).

Table 1. Demographic Characteristics and Psychological Scale Scores of the Participants

Variable	Category/ Min-Max	N/Median	%/ Mean±SD
Gender			
Female	27	54	
Male	23	46	
Department			
Anesthesiology	25	50	
Internal Medicine	25	50	
Seniority (Year of Residency)			
1st year	12	24	
2nd year	8	16	
3rd year	13	26	
4th year	8	16	
5th year	9	18	
PSS-10 Score			
<14	6	12	
≥14	44	88	
PSS-10 Score (Numeric)	9.0 – 33.0	20.0	20.4±5.7
PSWQ Score			
<40	15	30	
≥40	35	70	
PSWQ Score (Numeric)	23.0 – 72.0	45.5	46.6±11.6
STAI-I Score			
<40	22	44	
≥40	28	56	
STAI-I Score (Numeric)	20.0 – 80.0	42.5	43.4±12.5
STAI-II Score			
<44	16	32	
≥44	34	68	
STAI-II Score (Numeric)	20.0 – 68.0	43.5	43.1±10.2
VAS Score Pre-Shift			
<5	37	74	
≥5	13	26	
VAS Score Pre-Shift (Numeric)	0.0 – 8.0	3.0	3.4±2.0
VAS Score Post-Shift			
<5	25	50	
≥5	25	50	
VAS Score Post-Shift (Numeric)	0.0 – 7.0	4.0	4.2±2.0

PSS-10: Perceived Stress Scale; PSWQ: Penn State Worry Questionnaire; STAI-I and STAI-II: State-Trait Anxiety Inventory; VAS:Visual Analog Scale.

STAI-I and STAI-II scores were comparable between the two groups (STAI-I: 42.8±13.6 vs. 44.0±11.6, p=0.747; STAI-II: 44.1±9.5 vs. 42.1±11.0, p=0.502). The proportion of partici-

Table 2. Comparison of Internal Medicine and Anesthesiology Residents According to Sociodemographic and Scale Scores

Variable	Internal Medicine (n=25) Mean±SD (Median)/ n (%)	Anesthesiology (n=25) Mean±SD (Median)/ n (%)	p
Gender			
Female	13 (52.0)	14 (56.0)	0.777*
Male	12 (48.0)	11 (44.0)	
Seniority			
1st year	8 (32.0)	4 (16.0)	0.021*
2nd year	6 (24.0)	2 (8.0)	
3rd year	5 (20.0)	8 (32.0)	
4th year	2 (8.0)	6 (24.0)	
5th year	4 (16.0)	5 (20.0)	
PSS-10 Score			
Score	21.0±5.8 (20)	19.9±5.7 (20)	0.494**
<14	3 (12.0)	3 (12.0)	1.000*
≥14	22 (88.0)	22 (88.0)	
PSWQ Score			
Score	47.4±11.7 (49)	45.7±11.7 (44)	0.614**
<40	7 (28.0)	8 (32.0)	0.758*
≥40	18 (72.0)	17 (68.0)	
STAI-I Score			
Score	42.8±13.6 (43)	44.0±11.6 (42)	0.747**
<40	10 (40.0)	12 (48.0)	0.569*
≥40	15 (60.0)	13 (52.0)	
STAI-II Score			
Score	44.1±9.5 (45)	42.1±11.0 (43)	0.502**
<40	8 (32.0)	8 (32.0)	1.000*
≥44	17 (68.0)	17 (68.0)	
VAS Score (Pre-Shift)			
Score	3.3±2.2 (3)	3.5±1.8 (3)	0.632***
<5	18 (72.0)	19 (76.0)	0.747*
≥5	7 (28.0)	6 (24.0)	
VAS Score (Post-Shift)			
Score	3.8±2.0 (3)	4.6±2.0 (6)	0.119***
<5	14 (56.0)	11 (44.0)	0.396*
≥5	11 (44.0)	14 (56.0)	

*Chi Square Test; **Mann Whitney U Test; ***T Test; PSS-10: Perceived Stress Scale; PSWQ: Penn State Worry Questionnaire; STAI-I and STAI-II: State-Trait Anxiety Inventory; VAS: Visual Analog Scale.

pants scoring above cutoff points for STAI-I (≥40) and STAI-II (≥44) was also similar (Table 2).

VAS scores for anxiety measured before and after shifts showed no significant difference between groups (pre-shift: 3.3±2.2 vs. 3.5±1.8, p=0.632; post-shift: 3.8±2.0 vs. 4.6±2.0, p=0.119). The percentage of participants scoring above the cutoff (VAS≥5) was comparable pre-shift (28.0% vs. 24.0%) and post-shift (44.0% vs. 56.0%) between Internal Medicine and Anesthesiology groups (Table 2).

Correlation Analysis Findings

According to the results of the Spearman correlation analysis, there was no statistically significant correlation between years of residency and scores on the PSS-10, PSWQ, STAI-I, STAI-II, pre-shift VAS, and post-shift VAS scales (p>0.05 for all). The observed correlation coefficients were weak and negative in direction. The strongest negative correlation was found between years of residency and the PSS-10 score (r=–0.176), though this was not statistically significant (p=0.222). These findings suggest that as residency seniority increases, there is no notable change in levels of stress, worry, or anxiety (Table 3).

DISCUSSION

This study aimed to compare the impact of 24-hour shift-related work conditions on anxiety, stress, and pathological worry among anesthesiology and reanimation residents and internal medicine residents during their specialty training. Existing literature supports the notion that clinical specialty and years of experience significantly influence healthcare workers' psychological well-being.[10] However, our findings reveal no statistically significant differences between the two groups in anxiety levels measured by the VAS at both the beginning and end of the shifts, nor in STAI-I and STAI-II scores measured at shift onset.

Despite the lack of statistical significance, descriptive analyses indicated that a substantial proportion of anesthesiology residents experienced elevated anxiety, with 76.0% scoring above the VAS cut-off (≥5) before shifts and 56.0% after shifts, compared to 72.0% and 44.0% in internal medicine residents, respectively. Similarly, trait anxiety (STAI-II) was elevated in 68.0% of residents from both groups. These trends suggest that the demanding nature of anesthesiology, characterized by greater exposure to acute emergencies and responsibility for patient safety, may contribute to higher baseline anxiety, although this did not reach statistical significance.

Regarding stress, Perceived Stress Scale (PSS-10) scores showed no significant difference between groups, yet 88.0% of residents in both specialties scored above the cut-off (≥14), reflecting high perceived stress levels over the preceding month. This finding aligns with prior studies indicating that medical residents, regardless of specialty, endure considerable chronic stress that may affect their mental health and performance.[11]

Table 3. Correlation Between Resident Seniority and Psychometric Scale Scores

Variable	PSS-10	PSWQ	STAI-I	STAI-II	VAS (Pre-Shift)	VAS (Post-Shift)
Spearman's ρ (r)	–0.176	–0.104	–0.092	–0.094	–0.081	0.025
p-value	0.222	0.474	0.524	0.514	0.578	0.865

PSS-10: Perceived Stress Scale; PSWQ: Penn State Worry Questionnaire; STAI-I and STAI-II: State-Trait Anxiety Inventory; VAS: Visual Analog Scale.

Similarly, the Penn State Worry Questionnaire (PSWQ) results revealed comparable rates of pathological worry (≥40) among anesthesiology (68.0%) and internal medicine (72.0%) residents. Such pervasive worry may be influenced by factors beyond shift work, including the hierarchical structure of medical training, institutional culture, and the inherent uncertainties of clinical practice—factors previously identified as modulators of resident anxiety.[12]

Furthermore, our findings regarding the high prevalence of stress and anxiety among residents are consistent with recent research conducted in similar settings. For instance, a study conducted in a tertiary training hospital in Türkiye demonstrated elevated depression levels and identified workload and shift patterns as significant factors affecting residents' mental health.[13] This parallel underscores the widespread nature of psychological distress among resident physicians and highlights the urgent need for institutional interventions aimed at mental health support across specialties.

Similar to other studies in the literature,[14] our findings underscore the necessity of optimizing working conditions and providing psychological support within healthcare institutions to alleviate the anxiety, stress, and worry experienced by healthcare professionals. Addressing these factors is crucial for improving the well-being and performance of resident physicians.

Contrary to several reports associating longer or more frequent shifts with increased anxiety and stress symptoms,[15,16] our study did not find significant correlations between seniority and any of the psychological measures (PSS-10, PSWQ, STAI-I, STAI-II, or VAS scores). This may indicate that stress and anxiety are pervasive throughout residency, irrespective of experience level, highlighting the chronic nature of psychological strain in these professions.

The absence of statistically significant intergroup differences and correlations may also reflect the relatively small sample size or unmeasured confounding variables such as individual coping strategies, social support, and institutional wellness resources. Future multicenter, longitudinal studies with larger samples are warranted to further elucidate these complex relationships and to identify effective interventions tailored to specialty-specific stressors.

Limitations

Several limitations should be acknowledged regarding this study. First, the study was conducted at a single tertiary training hospital, which may limit the generalizability of the findings to other institutions with different working conditions, resident populations, or organizational cultures. Second, the relatively small sample size may have reduced the statistical power to detect subtle differences or correlations between variables. Third, the cross-sectional design captures residents' psychological states at specific points in time but does not allow for assessment of causal relationships or fluctuations over longer periods. Fourth, the reliance on self-reported questionnaires may introduce response bias, including social desirability or underreporting of psychological distress due to stigma. Finally, unmeasured confounding factors such as individual coping mechanisms, support systems, workload intensity, and personal life stressors were not controlled for, which could have influenced the results.

Future studies incorporating larger, multicenter cohorts with longitudinal follow-up and mixed-method approaches are recommended to overcome these limitations and provide more comprehensive insights into the mental health of resident physicians.

CONCLUSION

This study highlights that both anesthesiology and internal medicine residents experience high levels of anxiety, stress, and pathological worry associated with 24-hour shift work, regardless of differences in specialty or seniority. Although no statistically significant differences were found between the groups, the overall elevated psychological distress underscores the need for targeted mental health support and interventions within residency programs. Future research with larger, multicenter cohorts is essential to better understand specialty-specific stressors and to develop effective strategies to enhance the well-being and performance of residents.

DECLARATIONS

Ethics Committee Approval: The study was approved by Health Sciences University Istanbul Training and Research Hospital Clinical Research Ethics Committee (No: 94, Date: 18/04/2025).

Informed Consent: Written informed consent was obtained from all participants.

Conflict of Interest: The authors declare that there is no conflict of interest.

Funding: This study received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Use of AI for Writing Assistance: Not declared.

Authorship Contributions: Concept – AT, MO; Design – AT, SB, GC, OA, MO; Supervision – AT, MO; Fundings – AT, SB, GC, OA, MO; Materials – AT, SB, GC, OA, MO; Data collection &/or processing – AT, SB, GC, OA, MO; Analysis and/or interpretation – AT, SB, GC, OA, MO; Literature search – AT, SB, GC, OA, MO; Writing – AT, SB, GC, OA, MO; Critical review – AT, SB, GC, OA, MO.

Acknowledgments: The authors sincerely thank all the assistant physicians who participated in this study for their valuable time and cooperation. We also thank the administrative staff of the Anesthesiology and Internal Medicine departments for their support in facilitating the data collection process. Finally, we thank our colleagues for their valuable feedback during the preparation of this article.

Peer-review: Externally peer-reviewed.

REFERENCES

1. De Cassai A, Negro S, Geraldini F, Boscolo A, Sella N, Munari M, et al. Inattentional blindness in anesthesiology: A gorilla is worth one thousand words. PLoS One 2021;16:e0257508.
2. Pasin L, Sella N, Correale C, Boscolo A, Mormando G, Zordan M, et al. Pandemic COVID-19: the residents' resilience. Acta Biomed 2020;91:e2020120.
3. Daviu N, Bruchas MR, Moghaddam B, Sandi C, Beyeler A. Neurobiological links between stress and anxiety. Neurobiol Stress 2019;11:100191.
4. Al-Amer R, Malak MZ, Aburumman G, Darwish M, Nassar MS, Randal S, et al. Prevalence and correlates of psychological reactions among jordanian nurses during the coronavirus disease 2019 pandemic. 2020. Available at: https://www.researchsquare.com/article/rs-35820/v1. Accessed Aug 12, 2023.
5. Dehelean L, Papava I, Musat MI, Bondrescu M, Bratosin F, Bucatos BO, et al. Coping strategies and stress related disorders in patients with COVID-19. Brain Sci 2021;11:1287.
6. Yip YC, Yip KH, Tsui WK. The transformational experience of junior nurses resulting from providing care to COVID-19 patients: from facing hurdles to achieving psychological growth. Int J Environ Res Public Health 2021;18:7383.
7. Pedrabissi L, Santinello M. Verification of the validity of the STAI, Form Y, by Spielberger. Giunti Organizzazioni Speciali 1989;191-192:11–4.
8. Messineo L, Tosto C. Evaluation of the psychometric properties of the Italian version of the 10-item perceived stress scale in a sample of teachers. Front Psychol 2024;14:1330789.
9. Morani S, Pricci D, Sanavio E. Penn State Worry Questionnaire e Worry Domains Questionnaire. Presentazione delle versioni italiane ed analisi della fedeltà. Psicoterapia Cognitiva e Comportamentale 1999;5:195–209. [Article in Italian]
10. Sun P, Wang M, Song T, Wu Y, Luo J, Chen L, et al. The psychological impact of covid-19 pandemic on health care workers: a systematic review and meta-analysis. Front Psychol 2021;12:626547.
11. Vizheh M, Qorbani M, Arzaghi SM, Muhidin S, Javanmard Z, Esmaeili M. The mental health of healthcare workers in the COVID-19 pandemic: A systematic review. J Diabetes Metab Disord 2020;19:1967–78.
12. Speroff T, Nwosu S, Greevy R, Weinger MB, Talbot TR, Wall RJ, et al. Organisational culture: variation across hospitals and connection to patient safety climate. Qual Saf Health Care 2010;19:592–6.
13. Gücüyener MB, Topaçoğlu H, Dikme Ö, Gücüyener BG. Determination of depression levels and affecting factors of the residents in a training hospital. Istanbul Med J 2024;25:127–31.
14. Laza R, Lustrea A, Lazureanu VE, Marinescu AR, Nicolescu N, Herlo A, et al. Untangling the professional web: Understanding the impact of work-related factors on the mental health of healthcare professionals during the late stages of Covid-19 pandemic. J Multidiscip Healthc 2023;16:2391–404.
15. Afonso P, Fonseca M, Pires JF. Impact of working hours on sleep and mental health. Occup Med (Lond) 2017;67:377–82.
16. Lollis BD, Kumar M, Kaplan J, Schmelzer C, Harthcock K, Silva M. The on-call burden of physicians: discussion, recommendations and risk mitigation strategies. Clin Case Rep J 2020;1:1–5.

ORIGINAL ARTICLE

European Archives of Medical Research

DOI: 10.14744/eamr.2025.84429
Eur Arch Med Res 2025;41(4):235–240

Radial Bowing and Obesity: Do They Increase The Need For Surgical Intervention in Pediatric Radial Epiphyseal Fractures?

Hakan Sesen, Ugur Kadir Kartal

Department of Orthopedics and Traumatology, Health Sciences University Ankara Atatürk Sanatorium Training and Research Hospital, Ankara, Türkiye

ABSTRACT

Objective: Radial physeal fractures are the most common growth plate injuries in children. While most are treated nonoperatively, some cases require surgical intervention due to initial displacement or loss of reduction. Individual biomechanical factors such as radial bowing and obesity-related soft-tissue mass may influence fracture stability but remain underexplored. This study aimed to assess whether increased radial bowing and body mass index (BMI) are associated with a higher risk of requiring surgical treatment in pediatric radial epiphyseal fractures.

Materials and Methods: In this retrospective observational study, 106 children aged 2–16 years with isolated proximal or distal radial epiphyseal fractures were analyzed. Radiographic parameters, including radial bowing (percentage and location) and soft-tissue-to-bone ratio (SKYO), were measured on the contralateral intact forearm. BMI percentiles were calculated, and fracture characteristics were recorded. The primary outcome was the need for surgical treatment; secondary outcomes included re-reduction rates and associations between anatomical variables and treatment approach. Statistical analyses included Student's t-tests and Spearman correlation.

Results: Of 106 patients (63.2% male; mean age: 10.2 years), only 2 (1.9%) underwent surgery. The mean radial bowing was 6.24% (range: 4.4–8.71), with an average bowing location at 61.2% of radial length. Mean SKYO was 33.1%, and average BMI percentile was 68.67. No significant relationship was found between radial bowing, SKYO, or BMI and the need for surgery. A positive correlation was observed between radial bowing and SKYO (p=0.032), and an inverse correlation between BMI percentile and SKYO (p=0.041).

Conclusion: Radial bowing and soft-tissue thickness (SKYO), although anatomically variable, were not predictive of surgical need in pediatric radial epiphyseal fractures. Nearly all cases were effectively managed conservatively, with excellent functional outcomes. These findings suggest that individual anatomical variation, including radial bowing and BMI, should not influence initial surgical decision-making in physeal fractures of the radius.

Keywords: Pediatric orthopedics, Physeal injuries, Radial fractures

Cite this article as: Sesen H, Kartal UK. Radial Bowing and Obesity: Do They Increase The Need For Surgical Intervention in Pediatric Radial Epiphyseal Fractures? Eur Arch Med Res 2025;41(4):235–240.

Address for correspondence: Hakan Sesen. Department of Orthopedics and Traumatology, Health Sciences University Ankara Atatürk Sanatorium Training and Research Hospital, Ankara, Türkiye

E-mail: hakansesen73@gmail.com **ORCID ID:** 0000-0001-6874-7061

Submitted: 22.01.2025 **Revised:** 03.05.2025 **Accepted:** 04.08.2025 **Available Online:** 20.10.2025

European Archives of Medical Research – Available online at www.eurarchmedres.org

INTRODUCTION

Radial growth plate fractures represent the most common type of physeal injury in the pediatric population, primarily due to the vulnerability of the distal radial physis during growth periods.[1] These injuries can involve both the distal and proximal ends of the radius. In addition, metaphyseal fractures and diaphyseal fractures that do not affect the physis are also frequently encountered in children.[2] Because the physis is the primary center for longitudinal bone growth, injuries involving this region carry the potential risk of physeal arrest. Subsequent complications such as angular deformities or limb length discrepancies may arise as a result of premature physeal closure.[1] As such, early identification and accurate management of these fractures are paramount to ensuring proper skeletal development and minimizing long-term disability.

The clinical decision-making process for the management of radial growth plate fractures often involves determining the necessity of surgical intervention. While many of these fractures can be treated nonoperatively through closed reduction and casting, failure to achieve or maintain adequate reduction can necessitate surgical treatment. In some instances, insufficient reduction during the initial emergency department visit may be the cause, while in other cases, displacement may occur during follow-up despite appropriate initial treatment.[1] Although current classification systems and treatment guidelines provide general criteria for acceptable alignment, they do not fully account for individual anatomic or biomechanical factors that may predispose a fracture to instability.

One such potential factor is the natural radial bowing of the forearm, which is known to vary among individuals. An increased radial bow may theoretically alter the biomechanics of the radius in a way that contributes to either initial displacement or subsequent loss of reduction. However, the relationship between radial bowing and the risk of surgical intervention in physeal fractures has not been well established in the pediatric population.

Moreover, body habitus–particularly the impact of obesity–has been increasingly recognized as a potential risk factor in pediatric orthopedic trauma. Excess body weight may increase the mechanical load on the skeleton, potentially influencing fracture patterns and stability. However, the role of body weight and height as independent risk factors for surgical treatment in radial physeal injuries remains underexplored in the literature.

In this study, we aimed to investigate whether increased radial bowing and elevated body mass index (BMI) are associated with a higher risk of requiring surgical intervention in pediatric radial epiphyseal fractures. We hypothesized that both increased radial bowing and higher BMI act as biomechanical stressors, potentially contributing to initial fracture displacement and increasing the likelihood of fracture instability, thereby necessitating surgical management.

MATERIALS AND METHODS

Study Design and Participants

This retrospective observational study included pediatric patients who presented to the emergency department of our hospital with proximal or distal radial epiphyseal fractures between June 2021 and January 2023. A total of 126 patients were initially identified. Standard anteroposterior and lateral forearm radiographs obtained during emergency department visits and follow-up outpatient clinic visits were evaluated. Twenty patients who failed to attend follow-up visits or whose radiographic data were incomplete were excluded from the analysis. The final study population consisted of 106 patients. Of these, 67 were male and 39 were female, with ages ranging from 2 to 16 years. Inclusion criteria were as follows: Age between 2 and 16 years, presence of an isolated epiphyseal fracture of the radius (proximal or distal), and availability of comparative radiographs of both forearms. Exclusion criteria were as follows: Open fractures, concurrent fractures of other bones in the same limb, history of previous fracture in the same arm, and congenital anomalies affecting the upper limbs.

Data Collection and Measurements

Demographic data including age, sex, height, and weight were recorded. Fracture characteristics such as location (proximal or distal), affected side (right/left), and classification according to the Salter-Harris system were documented. Radial bowing measurements were performed on the intact contralateral forearm using standard anterior-posterior radiographs. The maximum perpendicular distance (r) from the radius's diaphyseal arc to a straight line (x) connecting the radial head and distal radial metaphysis was used to calculate radial bowing. Bowing location (y/x) was calculated by identifying the distance (y) from the radial head to the point of maximum bowing along the line x (Fig. 1). Soft-tissue thickness measurements were performed on the same radiographs. The total transverse skin-to-skin forearm width (c) at the level of radial midshaft was measured. At the same level, the sum of radial and ulnar bone widths (a+b) was measured. The soft-tissue-to-bone ratio (SKYO) was then calculated using the formula: $(a+b)/c \times 100$ (Fig. 2). These values were used to assess whether increased soft-tissue thickness (as a surrogate for obesity) was associated with a need for surgical intervention or re-reduction.

Outcome Assessment

The primary outcome was the need for surgical intervention (initial or during follow-up). Secondary outcomes included the need for re-reduction and the correlation of this with anatomical and anthropometric variables.

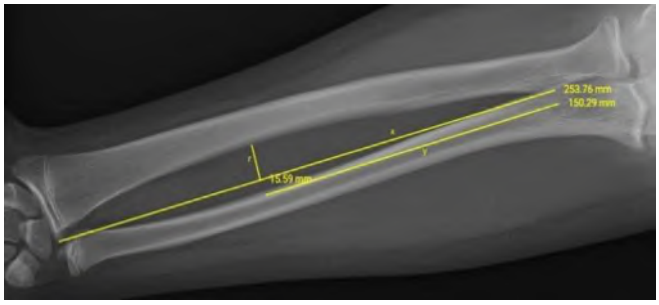


Figure 1. Measurement method for radial bowing and the location of maximum bowing as per the method described by Firl and Wünsch (2004).[3] The radial bowing (r/x) was calculated by measuring the maximum perpendicular distance (r) from the shaft of the radius to a straight line (x) drawn from the radial head to the radial styloid process on an anteroposterior radiograph. The bowing location (y/x) was defined as the distance (y) from the proximal radial end to the point of maximal bowing, divided by the total radial length (x).

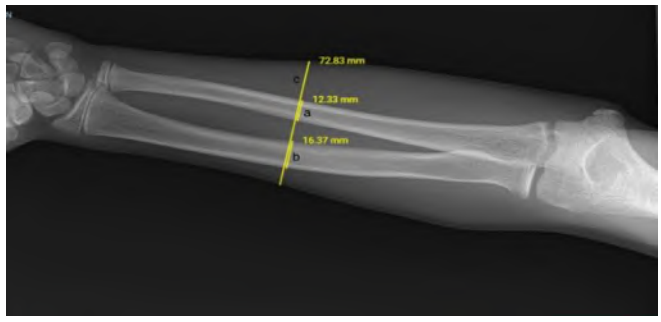


Figure 2. Measurement of the soft-tissue-bone ratio on a lateral forearm radiograph: The ratio of soft-tissue thickness to radial bone diameter at the point of maximal bowing. Anteroposterior radiographs were used to measure the sum of radial and ulnar widths (a+b) at the mid-diaphyseal level, and the total forearm width from skin to skin (c) at the same level. The soft-tissue-to-bone ratio was calculated using the formula: [(a+b)/c]×100. This ratio was used as a radiographic surrogate for soft-tissue thickness and potential obesity.

Ethics

This study was approved by the Institutional Ethics Committee on June 22, 2021, under approval number 2012-KAEK-15/2332. Our study was conducted in accordance with the Declaration of Helsinki.

Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics for Windows, Version 22.0 (IBM Corp., Armonk, NY). Descriptive statistics were presented as means±standard deviation for continuous variables and frequencies (n) and percentages (%) for categorical variables. The Kolmogorov–Smirnov test was used to assess the normality of data distribution, as the sample size was >50. Comparisons of continuous variables between two independent groups (e.g., surgical vs. non-surgical treatment groups) were performed using the Student's t-test for normally distributed variables. The relationship between radial bowing, bowing location, BMI (derived from height and weight), and SKYO with the need for surgery was assessed using the Spearman rank correlation test, as some variables were ordinal or non-normally distributed. $P<0.05$ was considered statistically significant in all analyses.

RESULTS

A total of 106 patients were included in the study, with 67 males (63.2%) and 39 females (36.8%). The mean age was 10.2 years (range: 2–16 years). Patients were followed for a minimum of 2 years. Radiographs taken during emergency admission, outpatient follow-up, and at the 6th and 12th months post-union were included in the evaluation.

The mean radial bowing in the intact arms was 6.24%, ranging from 4.4% to 8.71%. The location of bowing along the radial shaft was on average 61.2%, with a minimum of 49.45% and a maximum of 71.62% (Fig. 3). The average BMI percentile of the patients was 68.67. Distribution was as follows: 20 patients (19%) were above the 95th percentile, 25 (23%) between the 85th and 95th, 58 (55%) between the 5th and 85th, and 3 (2.8%) below the 5th percentile. The intact forearm SKYO had a mean of 33.1%, ranging from 23% to 48%.

According to the Salter-Harris classification, 93 patients (94%) had type II fractures, while the remaining had other types. Two patients (1.9%) underwent surgical treatment (one distal, one

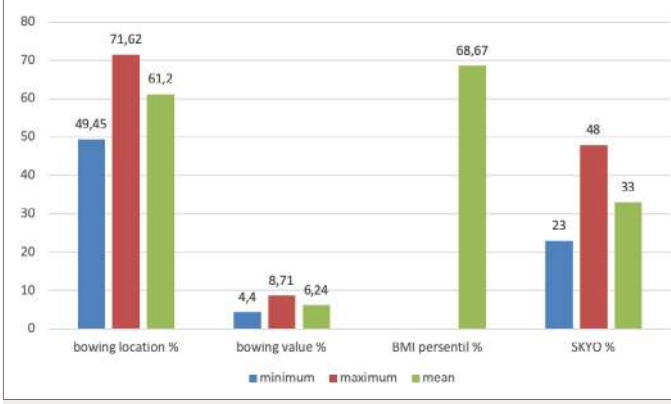


Figure 3. Distribution histogram of radial bowing percentage and bowing location among patients. Most values fall within the expected normal anatomical range.

proximal radial epiphyseal fracture), while the remaining 104 (98.1%) were treated with cast immobilization post-closed reduction. No significant relationship was found between the degree of radial bowing and the need for surgery. No statistically significant differences were found between gender and radial bowing, bowing location, or SKYO (p=0.779, p=0.415, and p=0.951, respectively) (Fig. 4).

Spearman correlation analysis (Table 1) revealed: A significant inverse relationship between age and BMI percentile (p=0.000), a positive correlation between radial bowing and SKYO (p=0.032), and a negative correlation between BMI percentile and SKYO (p=0.041). No association was found between fracture location (proximal or distal) and radial bowing or SKYO.

Among the non-operated group, all post-reduction angulation and displacement values were within acceptable limits and normalized during follow-up. Seventeen patients developed cast-related soft-tissue complications; five required splint conversion. All cases resolved without sequelae. At the 1-year follow-up, range of motion was symmetric with the contralateral limb. VAS pain scores ranged from 0 to 1; 85 patients scored 0, and 21 scored 1. All patients eventually reported pain-free active motion. 4.

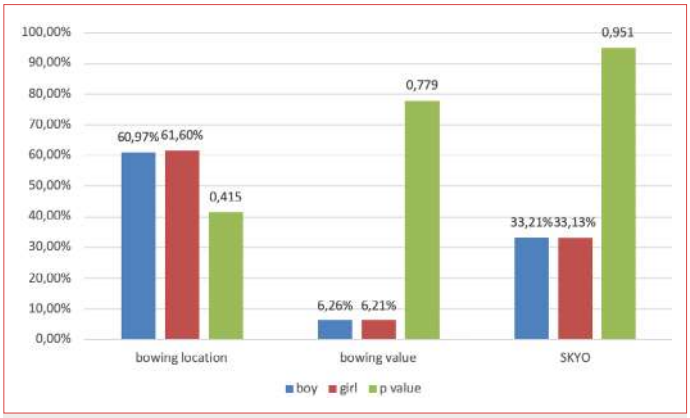


Figure 4. Comparison of radial bowing, SKYO, and bowing location between genders. No statistically significant differences were observed.

DISCUSSION

This study aimed to evaluate the potential risk factors – including radial bowing, SKYO, and obesity–for surgical intervention in radial growth plate fractures in children. The most significant findings were the lack of association between radial bowing and the need for surgery, and the novel observation that increased radial bowing correlates with increased SKYO. Moreover, a higher BMI percentile was associated with a lower SKYO value.

Our results support earlier observations that most growth plate fractures, especially Salter-Harris type II, can be effectively managed with conservative treatment. The findings align with the descriptive bowing studies of Firl[3] and Weber et al.,[4] who documented typical bowing values and locations in healthy pediatric populations. Our study confirmed that these normal anatomical variations do not predispose children to more severe injury outcomes requiring surgical correction.

The very low surgical intervention rate (1.9%) in our cohort supports previous work. For instance, Larsen et al.[5] showed that physis fractures are predominantly treated conservatively with favorable outcomes. Similarly, the high incidence of distal radial physis fractures in our study (94.3%) echoes epidemiological data by Randsborg et al.[6] and de Putter et al.,[7] who both found distal radius fractures to be the most common in children.

A novel aspect of this study is the measurement of SKYO and its positive correlation with radial bowing (p=0.032). While no prior research has investigated this relationship, our findings raise questions about whether increased SKYO is an adaptive or protective response to greater bowing stress, or a coinci-

Table 1. Spearman correlation coefficients among radial bowing, location of bowing, SKYO, age, and BMI percentile

	Age	Radial bowing location p-value	Radial bowing p-value	BMI persentil p-value	Intact forearm bone soft tissue ratio p-value
Age		0.06	0.74	0.00	0.741
Radial bowing location	0.06		0.39	0.108	0.528
Radial bowing	0.7	0.39		0.87	0.032
BMI persentil	0.00	0.1	0.87		0.041
SKYO	0.74	0.52	0.03	0.41	

Statistically significant correlations are marked in bold (p<0.05), BMI: Body mass index, SKYO: Soft-tissue-to-bone ratio.

dental anatomical variant. Since increased SKYO represents a higher bone mass relative to soft tissue at the radial midline, this might reflect developmental adaptation rather than a pathological marker.

Regarding obesity, prior research has shown it to be a risk factor for fractures. Studies by Liu,[8] Li,[9] and Seeley[10] demonstrated associations between high BMI and various pediatric upper extremity fractures. However, our study did not find any relationship between BMI percentile and the need for surgery or re-reduction in physis fractures. The only observed effect was a decrease in SKYO with increasing BMI (p=0.041), possibly indicating that obese children have more soft-tissue coverage around the forearm, potentially buffering mechanical forces.[11]

Almost all our patients were successfully managed with closed reduction and casting. This is consistent with the outcomes of McQuinn,[12] Jordan,[13] and Sengab et al.,[14] who identified initial displacement severity – not anatomical bowing – as the main predictor for surgical need in distal radius fractures. Our study builds on this by suggesting that radial bowing is not a determinant of treatment failure. Ramoutar et al.[15] demonstrated that early surgical intervention in displaced distal radius fractures shortened the treatment duration and improved radiographic outcomes. Furthermore, in a Cochrane meta-analysis conducted by Handoll et al.,[16] it was reported that distal radius fractures in children yielded similar functional outcomes whether treated conservatively or surgically, with surgical intervention being required at a low rate.

This study sets the groundwork for future investigation into SKYO as a measurable, reproducible radiographic parameter in children. It may also inspire additional research into whether higher SKYO values can be used to estimate fracture risk, guide immobilization strategies, or predict remodeling potential in pediatric upper limb fractures.

In the broader context of pediatric fracture management, this study contributes novel insight into anatomical and biomechanical factors that do not necessitate surgical intervention. The finding that high BMI does not equate to worse outcomes in physis fractures is particularly relevant, highlighting the resilience and remodeling potential of the growth plate region.

Limitations

Limitations include the lack of a healthy control group to establish normative values of SKYO across ages. In addition, we did not evaluate radial bowing or SKYO in the context of metaphyseal or diaphyseal fractures. Future studies could also consider lateral plane bowing and include ulnar bowing as a comparative variable. Furthermore, the predictive value of SKYO for fracture occurrence or displacement risk remains unexplored and warrants prospective investigation.

CONCLUSION

This study demonstrates that neither the degree nor the location of physiological radial bowing, nor the SKYO, significantly affect the need for surgical intervention in pediatric radial epiphyseal fractures. Although a positive correlation was found between radial bowing and SKYO, and an inverse correlation between BMI percentile and SKYO, these anatomical and anthropometric variations did not influence treatment outcomes. Nearly, all fractures were successfully managed with conservative treatment, and patients achieved excellent functional recovery without long-term complications. These findings suggest that normal anatomical variations such as radial bowing and SKYO should not be considered risk factors for surgical requirement in growth plate injuries of the radius.

DECLARATIONS

Ethics Committee Approval: The study was approved by Ankara Keçiören Training and Research Hospital Chief Medical Officer's Office Clinical Research Ethics Committee (No: 2012-KAEK-15/2332, Date: 22/06/2021).

Conflict of Interest: The authors declare that there is no conflict of interest.

Funding: The authors received no financial support for the research and/or authorship of this article.

Use of AI for Writing Assistance: Artificial intelligence was not used in our study.

Authorship Contributions: Concept – HS; Design – HS; Supervision – HS, UKK; Fundings – HS, UKK; Materials – HS, UKK; Data collection &/or processing – HS, UKK; Analysis and/or interpretation – HS, UKK; Literature search – HS, UKK; Writing – HS, UKK; Critical review – HS, UKK.

Acknowledgments: This study was supported by T.C. University Of Health Sciences Ankara Atatürk Sanatoryum Health Applicatıon and Research Center Orthopedics And Traumatology Clinic.

Peer-review: Externally peer-reviewed.

REFERENCES

1. Pannu GS, Herman M. Distal radius-ulna fractures in children. Orthop Clin North Am 2015;46:235–48.
2. Hedström EM, Svensson O, Bergström U, Michno P. Epidemiology of fractures in children and adolescents. Acta Orthop 2010;81:148–53.
3. Firl M, Wünsch L. Measurement of bowing of the radius. J Bone Joint Surg Br 2004;86:1047–9.
4. Weber MB, Olgun ZD, Boden KA, Weinberg DS, Bafus BT, Cooperman DR, et al. A cadaveric study of radial and ulnar bowing in the sagittal and coronal planes. J Shoulder Elbow Surg 2020;29:1010–8.

5. Larsen MC, Bohm KC, Rizkala AR, Ward CM. Outcomes of nonoperative treatment of Salter-Harris II Distal radius fractures: A systematic review. Hand 2016;11:29–35.
6. Randsborg PH, Gulbrandsen P, Saltytė Benth J, Sivertsen EA, Hammer OL, Fuglesang HF, et al. Fractures in children: Epidemiology and activity-specific fracture rates. J Bone Joint Surg Am 2013;95:e42.
7. de Putter CE, van Beeck EF, Looman CW, Toet H, Hovius SE, Selles RW. Trends in wrist fractures in children and adolescents, 1997-2009. J Hand Surg Am 2011;36:1810–5.e2.
8. Liu Y, Liu C, Guo D, Wang N, Zhao Y, Li D. Effect of childhood overweight on distal metaphyseal radius fractures treated by closed reduction. J Orthop Surg Res 2021;16:182.
9. Li NY, Bruce WJ, Joyce C, Decker NM, Cappello T. Obesity's influence on operative management of pediatric supracondylar humerus fractures. J Pediatr Orthop 2018;38:e118–21.
10. Seeley MA, Gagnier JJ, Srinivasan RC, Hensinger RN, VanderHave KL, Farley FA, et al. Obesity and its effects on pediatric supracondylar humeral fractures. J Bone Joint Surg Am 2014;96:e18.
11. DeFrancesco CJ, Rogers BH, Shah AS. Obesity increases risk of loss of reduction after casting for diaphyseal fractures of the radius and ulna in children: An observational cohort study. J Orthop Trauma 2018;32:e46–51.
12. McQuinn AG, Jaarsma RL. Risk factors for redisplacement of pediatric distal forearm and distal radius fractures. J Pediatr Orthop 2012;32:687–92.
13. Jordan RW, Westacott D, Srinivas K, Shyamalan G. Predicting redisplacement after manipulation of paediatric distal radius fractures: The importance of cast moulding. Eur J Orthop Surg Traumatol 2015;25:841–5.
14. Sengab A, Krijnen P, Schipper IB. Risk factors for fracture redisplacement after reduction and cast immobilization of displaced distal radius fractures in children: A meta-analysis. Eur J Trauma Emerg Surg 2020;46:789–800.
15. Ramoutar DN, Shivji FS, Rodrigues JN, Hunter JB. The outcomes of displaced paediatric distal radius fractures treated with percutaneous Kirschner wire fixation: A review of 248 cases. Eur J Orthop Surg Traumatol 2015;25:471–6.
16. Handoll HH, Elliott J, Iheozor-Ejiofor Z, Hunter J, Karantana A. Interventions for treating wrist fractures in children. Cochrane Database Syst Rev 2018;12:CD012470.

ORIGINAL ARTICLE

European Archives of Medical Research

DOI: 10.14744/eamr.2025.90582
Eur Arch Med Res 2025;41(4):241–245

Prognostic Indicators in Pleural Effusion: A Retrospective Study

Ugur Temel, Sule Karadayi

Department of Thoracic Surgery, University of Health Sciences, Şişli Hamidiye Etfal Training and Research Hospital, İstanbul, Türkiye

ABSTRACT

Objective: This study aimed to investigate the association between clinical, biochemical, and hematological indicators and survival outcomes in patients diagnosed with pleural effusion.

Materials and Methods: A retrospective, single-center observational study was conducted, including 365 patients with pleural effusion between January 2020 and December 2024. Clinical data including age, gender, etiology, Eastern Cooperative Oncology Group (ECOG) performance status, Karnofsky score, and laboratory parameters such as albumin, C-reactive protein (CRP), the neutrophil-to-lymphocyte ratio (NLR), and platelet-to-lymphocyte ratio (PLR) were extracted from medical records. Survival trends were visualized descriptively using Empirical Cumulative Distribution Function plots.

Results: Among 365 patients, the most frequent etiologies were congestive heart failure and breast cancer. Patients with higher serum albumin (>3.0 g/dL), higher ECOG scores, and lower Karnofsky scores demonstrated shorter survival durations. Elevated CRP, NLR, and PLR levels were also associated with shorter survival. In descriptive analyses, higher NLR and PLR categories were associated with longer survival. No formal time-to-event tests were performed. No formal time-to-event statistical tests were performed.

Conclusion: Several routinely available clinical and laboratory parameters, particularly serum albumin, performance status scores, and inflammatory markers, may be useful for estimating prognosis in pleural effusion. These findings underscore the importance of integrating simple clinical data in the prognostic assessment of patients and warrant further validation in prospective studies using formal survival analysis.

Keywords: Neutrophil–lymphocyte ratio, platelet–lymphocyte ratio, Pleural effusion, Prognosis

Cite this article as: Temel U, Karadayi S. Prognostic Indicators in Pleural Effusion: A Retrospective Study. Eur Arch Med Res 2025;41(4):241–245.

INTRODUCTION

Pleural effusion is a frequently encountered clinical condition with a broad spectrum of underlying causes, including congestive heart failure (CHF), malignancy, infection, pulmonary embolism, systemic inflammatory diseases, and certain drug therapies.[1,2] Among these, malignant and infectious effusions are of particular clinical relevance due to their association with poor prognosis and the frequent requirement for invasive interventions.[1] Malignant pleural effusion (MPE), in particular, is a common complication of advanced-stage cancers such as lung, breast, and mesothelioma and is typically associated with substantial morbidity and limited survival. The pathophysiology of MPE involves either direct tumor infiltration of the pleura or impaired lymphatic drainage, resulting in the accumulation of fluid within the pleural space.[3]

Address for correspondence: Sule Karadayi. Department of Thoracic Surgery, University of Health Sciences, Şişli Hamidiye Etfal Training and Research Hospital, İstanbul, Türkiye

E-mail: sulekaradayi73@yahoo.com **ORCID ID:** 0000-0002-6639-5709

Submitted: 22.07.2025 **Revised:** 25.08.2025 **Accepted:** 26.08.2025 **Available Online:** 20.10.2025

European Archives of Medical Research – Available online at www.eurarchmedres.org

Recent studies have highlighted the potential prognostic value of various biochemical and inflammatory markers in patients with pleural effusion. Elevated pleural fluid C-reactive protein (CRP) levels have been shown to differentiate parapneumonic effusions from other etiologies with high sensitivity and specificity, supporting its role as a diagnostic and prognostic marker.[4] Similarly, the neutrophil-to-lymphocyte ratio (NLR) in pleural fluid has emerged as a simple yet informative parameter, particularly in distinguishing tuberculosis-related effusions from malignant or parapneumonic causes. Moreover, in pediatric patients with prolonged postoperative pleural effusion, an increased NLR change ratio was found to be significantly associated with poor treatment response and prolonged drainage, indicating its potential utility as a prognostic biomarker for treatment efficacy.[5,6]

This study aims to evaluate the prognostic significance of selected biochemical and hematological parameters – including total protein, hemoglobin, serum albumin, CRP, NLR, and platelet-to-lymphocyte ratio (PLR) – on survival in patients with pleural effusion. In this cohort, inflammatory ratios were analyzed as ordinal categories, and exploratory plots suggested that higher categories of NLR and PLR tended to show longer survival, although these findings require confirmation with formal survival analyses.

MATERIALS AND METHODS

This study was approved by the Local Ethics Committee, December 03, 2024, 4646. Our research was conducted in accordance with the ethical standards of the Declaration of Helsinki. This retrospective, single-center observational study included 365 patients diagnosed with pleural effusion between January 2020 and December 2024. Patients were evaluated and followed at a tertiary care center. Demographic, clinical, and laboratory data were collected from medical records, including age, sex, laterality of effusion, underlying etiology, need for drainage, total protein, hemoglobin, serum albumin, CRP, NLR, PLR, Eastern Cooperative Oncology Group (ECOG) performance status, Karnofsky performance score, treatment modality, and survival outcome.

Statistical Analysis

Descriptive statistics were used to summarize patient characteristics. Survival trends were illustrated using empirical cumulative distribution function (ECDF) plots stratified by clinical and biochemical parameters. These visualizations were descriptive only and not based on Kaplan–Meier estimates or formal statistical tests. No survival comparison tests such as the log-rank test or Cox regression analysis were conducted.

RESULTS

A total of 365 patients diagnosed with pleural effusion were included in the study. The mean age of the patients was 64.9±16.9 years, and the median age was 67 years (range: 13–99). Of the patients, 59.8% were male and 40.2% were female. The most frequently observed etiologies were CHF (n=50, 13.9%) and lung cancer (n=32, 6.4%) (Table 1). Survival was longer in patients with serum albumin levels below 3.0 g/dL compared to those with normal albumin levels (5.0 months vs. 3.0 months). Performance status was also associated with survival. According to ECOG score, the median survival was 5.0 months in patients with ECOG 0–1, whereas it decreased to 1.0 months in those with ECOG 3–4. Similarly, survival decreased as Karnofsky scores declined; while median survival was 5.0 months in patients with a Karnofsky score of 50, it decreased to 1.0–2.0 months in those with scores of 30 or below. Among hematological parameters, patients with higher neutrophil-to-lymphocyte ratio (N/L) had longer survival compared to those with lower N/L (5.0 months vs. 3.0 months). Similarly, survival was also better in patients with higher PLR (5.0 months vs. 4.0 months). Figures 1-7 present ECDF-based survival curves according to various clinical and biochemical indicators.

DISCUSSION

In this retrospective study of 365 patients with pleural effusion, several clinical and biochemical indicators were found to be associated with survival duration. Patients with lower albumin levels (<3.0 g/dL), higher ECOG or lower Karnofsky performance scores, and elevated inflammatory markers such as CRP, NLR, and PLR exhibited differences in survival trends. Although formal survival analysis methods such as Kaplan–Meier or Cox regression were not used, descriptive ECDF plots helped illustrate survival distributions across these subgroups.

According to Light RW's Textbook of Pleural Diseases, serum albumin is frequently considered in the context of pleural fluid evaluation and patient nutritional and inflammatory status.

Table 1. Etiological factors causing pleural effusion

Etiological factor	Number of cases (%)
Congestive heart failure	50 (13.9)
Lung cancer	32 (6.4)
Parapneumonic effusion	28 (7.8)
Breast cancer	26 (7.2)
Traumatic	21 (5.8)
Pleuritis	15 (4.2)
Mesothelioma	8 (2.2)

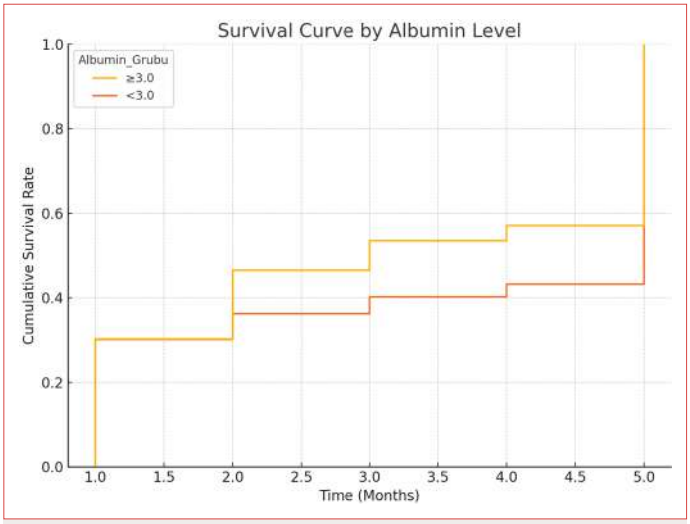


Figure 1. Empirical cumulative distribution function-based survival curve by albumin level (<3.0 vs. ≥3.0 g/dL).

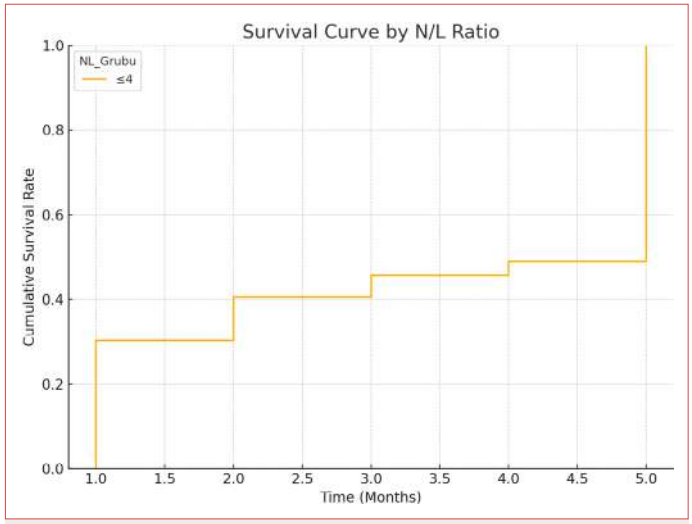


Figure 3. Empirical cumulative distribution function-based survival curve stratified by neutrophil-to-lymphocyte ratio (N/L low vs. high).

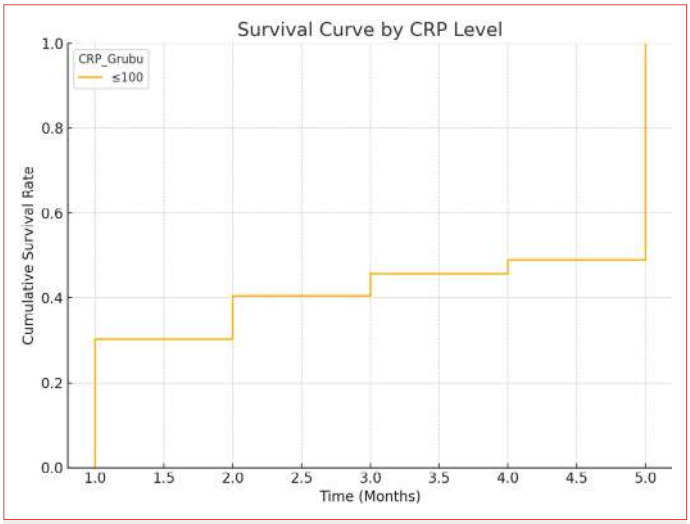


Figure 2. Empirical cumulative distribution function-based survival curve stratified by CRP level (≤100 vs. >100).

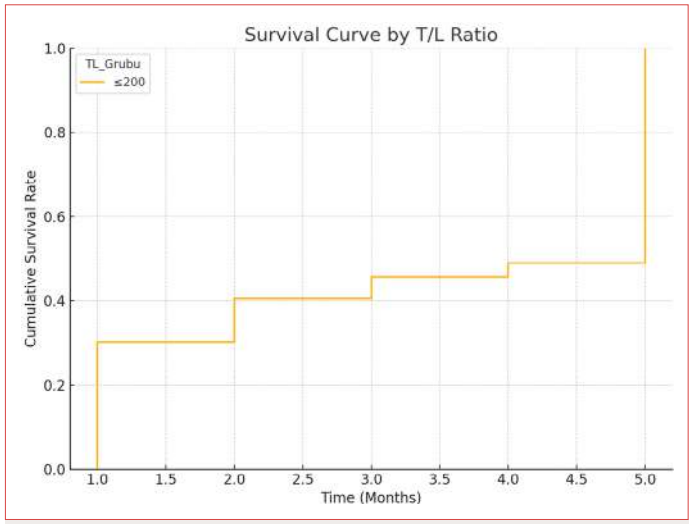


Figure 4. Empirical cumulative distribution function-based survival curve stratified by platelet-to-lymphocyte ratio (T/L low vs. high).

Although not an independent diagnostic marker for pleural effusion etiology, hypoalbuminemia is generally associated with poor functional reserve and increased morbidity, which may influence prognosis indirectly. The textbook also highlights that lower serum protein levels, particularly albumin, may correlate with worse outcomes in chronic or malignant effusions due to underlying systemic illness or cancer cachexia.[7]

The prognostic significance of serum albumin levels has been highlighted in numerous studies across cancer populations. Tang et al.[8] demonstrated, in a large NHANES-based cohort, that lower serum albumin levels were strongly associated with increased cancer-related mortality. Their multivariate Cox regression models revealed that patients with albumin levels ≤4.2 g/dL had significantly worse survival compared to those with higher levels, with hazard ratios exceeding 2.0 in some subgroups. Moreover, their analysis uncovered a consistent non-linear negative relationship between albumin concentration and mortality risk, indicating that even marginal declines in albumin may have prognostic value. These findings are aligned with the current study, where patients with lower albumin levels exhibited divergent survival trends. Although

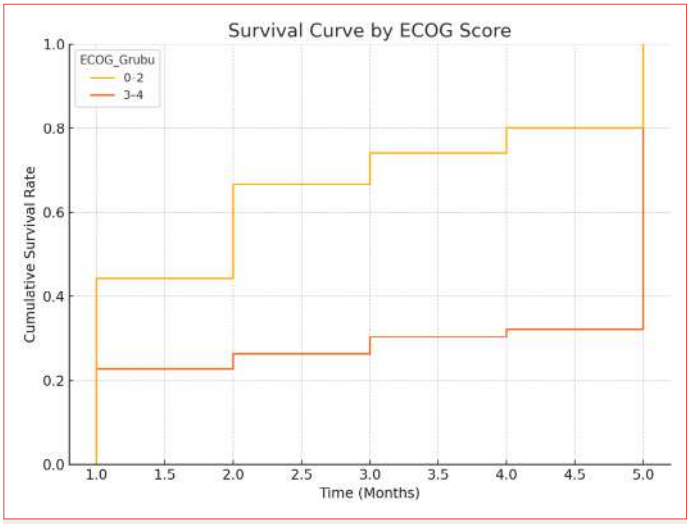


Figure 5. Empirical cumulative distribution function-based survival curve stratified by Eastern Cooperative Oncology Group performance score (0–2 vs. 3–4).

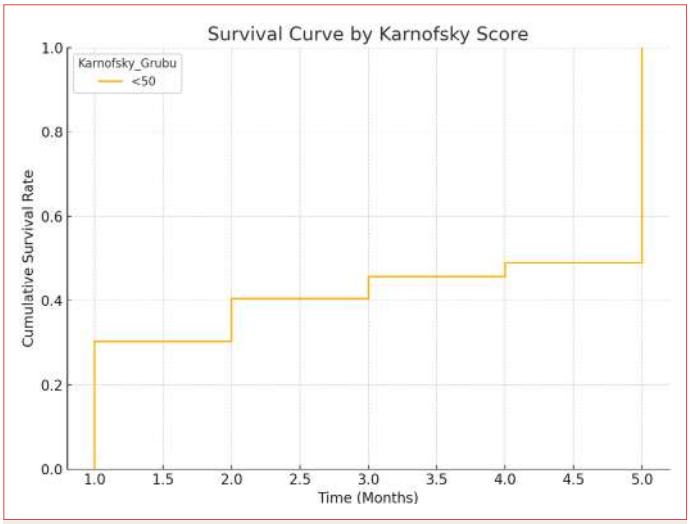


Figure 6. Empirical cumulative distribution function-based survival curve stratified by Karnofsky performance score (≥50 vs. <50).

formal survival modeling was not conducted here, our descriptive ECDF plots reinforce the hypothesis that hypoalbuminemia may be a marker of poorer prognosis in pleural effusion, particularly in malignant or inflammatory conditions.

Performance status has long been recognized as a crucial prognostic indicator in patients with MPE. In a study by Gayaf et al.,[9] ECOG performance status was found to be strongly associated with overall survival. Both ECOG and the LENT prognostic score showed comparable predictive power, with ECOG performing slightly better in long-term survival prediction.

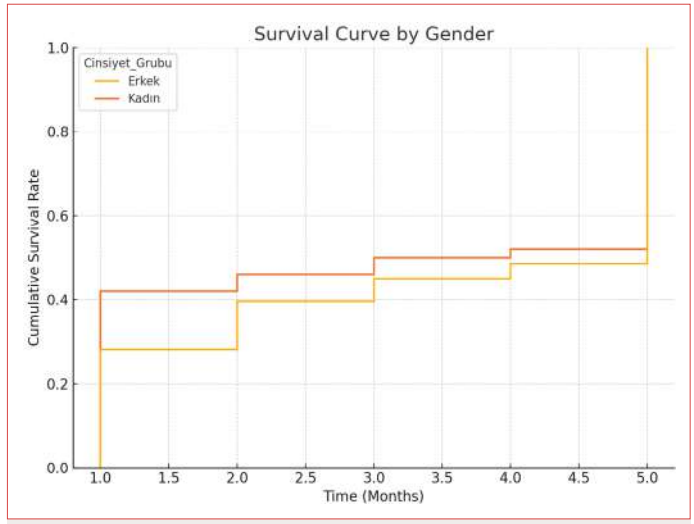


Figure 7. Empirical cumulative distribution function-based survival curve stratified by gender (male vs. female).

These findings align with our observations, where patients with higher ECOG scores had shorter survival. This reinforces the clinical utility of performance-based assessments in guiding prognosis and treatment decisions for MPE patients. In our corrected analysis, poorer performance status (higher ECOG scores) was associated with shorter survival, which is consistent with clinical expectations and prior literature.

Pleural fluid CRP has emerged as a useful biomarker for differentiating parapneumonic effusions from other causes of pleural effusion. In a large retrospective study by Izhakian et al.,[4] pleural CRP levels were significantly higher in parapneumonic effusions (mean 5.38±4.85 mg/dL) compared to effusions related to malignancy, heart failure, or lung transplantation. A CRP cut-off value of 1.38 mg/dL yielded 84.2% sensitivity and 71.5% specificity for identifying infectious etiologies, with a high negative predictive value of 96.7%. Moreover, CRP was selected as the strongest single predictor of parapneumonic effusion in multivariate analysis. These findings support the use of pleural CRP not only as a diagnostic tool but also as a potential marker for prognosis and therapeutic decision-making, especially in cases with suspected infection.

The NLR in pleural fluid has gained attention as an accessible and cost-effective inflammatory marker for differentiating exudative effusion etiologies. In a retrospective study by Akturk et al.,[5] NLR values were significantly lower in tuberculosis-related pleural effusion compared to malignant, para-pneumonic, and para-malignant effusions. While the median NLR was 2.2 in tuberculosis (TB) effusions, it ranged between 3.5 and 4.2 in other etiologies. This suggests that lower NLR values may support a diagnosis of TB pleurisy in the appropriate clinical context, whereas higher NLR values may be more indica-

tive of malignancy or bacterial infection. Although the role of NLR in prognostication remains limited, its diagnostic utility in guiding further investigations should not be underestimated.

Despite the strengths of our study–including a relatively large sample size and a broad spectrum of clinical and biochemical parameters–it has several limitations. First, the retrospective nature of the study limits the ability to control for confounding factors and to establish causal relationships. Second, survival analysis was based solely on descriptive ECDF plots without the use of time-to-event statistical methods such as Kaplan–Meier or Cox regression, which may limit the interpretability of survival differences across groups. Third, the lack of information on treatment specifics, disease stage, and comorbidities may have influenced survival outcomes.

CONCLUSION

Our findings suggest that commonly measured clinical and laboratory parameters – including serum albumin, performance status scores, CRP, NLR, and PLR – may provide prognostic insight in patients with pleural effusion. While these results require validation in prospective cohorts using formal survival analysis, they highlight the potential value of incorporating routine clinical data into early prognostic assessment and management planning in this patient population.

DECLARATIONS

Ethics Committee Approval: The study was approved by Şişli Hamidiye Etfal Education and Research Hospital Ethics Committee (No: 4646, Date: 03/12/2024).

Conflict of Interest: The authors declare that there is no conflict of interest.

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Use of AI for Writing Assistance: No generative AI or large language model tools were used in the design, analysis, or interpretation of the data. ChatGPT was only used for language editing and grammar suggestions. Final responsibility for the content lies with the authors.

Authorship Contributions: Concept – UT, SK; Design – UT; Supervision – SK; Data collection &/or processing – UT; Analysis and/or interpretation – UT; Literature search – SK; Writing – UT; Critical review – SK.

Peer-review: Externally peer-reviewed.

REFERENCES

1. Bedawi EO, Stavroulias D, Hedley E, Blyth KG, Kirk A, De Fonseka D, et al. Early video-assisted thoracoscopic surgery or ıntrapleural enzyme therapy in pleural ınfection: a feasibility randomized controlled trial. The third multicenter ıntrapleural sepsis Trial-MIST-3. Am J Respir Crit Care Med 2023;208:1305–15.
2. Cortes JE, Saglio G, Kantarjian HM, Baccarani M, Mayer J, Boqué C, et al. Final 5-year study results of DASISION: the dasatinib versus ımatinib study in treatment-naïve chronic myeloid leukemia patients Trial. J Clin Oncol 2016;34:2333–40.
3. Thomas R, Fysh ETH, Smith NA, Lee P, Kwan BCH, Yap E, et al. Effect of an indwelling pleural catheter vs talc pleurodesis on hospitalization days in patients with malignant pleural effusion: the AMPLE randomized clinical trial. JAMA 2017;318:1903–12.
4. Izhakian S, Wasser WG, Fox BD, Vainshelboim B, Kramer MR. The diagnostic value of the pleural fluid C-reactive protein in parapneumonic effusions. Dis Markers 2016;2016:7539780.
5. Akturk UA, Ernam D, Akbay MO, Koçak ND, Ogur E, Irmak I. Role of the neutrophil-lymphocyte ratio in the differential diagnosis of exudative pleural effusion. Clinics (Sao Paulo) 2016;71:611–6.
6. Yakuwa K, Miyaji K, Kitamura T, Miyamoto T, Ono M, Kaneko Y. Neutrophil-to-lymphocyte ratio is prognostic factor of prolonged pleural effusion after pediatric cardiac surgery. JRSM Cardiovasc Dis 2021;10:20480040211009438.
7. Heffner JE. Pleural fluid analysis. In: Light RW, Lee GC, editors. Textbook of pleural diseases. 3rd ed. Boca Raton: CRC Press; 2016. p.153–73.
8. Tang Q, Li X, Sun CR. Predictive value of serum albumin levels on cancer survival: a prospective cohort study. Front Oncol 2024;14:1323192.
9. Gayaf M, Anar C, Canbaz M, Doğan Bİ, Erbaycu AE, Güldaval F. Can LENT Prognostic score (LDH, ECOG performance score, blood neutrophil/lymphocyte ratio, tumor type) change the clinical approach in malignant pleural effusion? Tuberk Toraks 2021;69:133–43.

ORIGINAL ARTICLE

European Archives of Medical Research

DOI: 10.14744/eamr.2025.38980
Eur Arch Med Res 2025;41(4):246–252

Pre-Operative Cardiac Risk Assessment to Predict Mortality and Intensive Care Admission in Elderly Patients Scheduled for Non-Cardiac Surgery: Comparison of The Revised Cardiac and Geriatric Sensitive Cardiac Risk Indices With Cardiology-Determined Risk

Berna Caliskan, Goksu Guldal, Bengisu Seker, Simge Turk, Beste Aydin, Zeki Besir

Department of Anesthesiology and Reanimation, Haseki Training and Research Hospital, Istanbul, Türkiye

ABSTRACT

Objective: Pre-operative cardiovascular risk assessment using defined risk indices helps estimate adverse post-operative outcomes and mortality. The available data does not support a single best approach, especially for elderly patients. We aimed to reveal the relationship of cardiac risk indices used pre-operatively with in-hospital mortality and intensive care unit (ICU) admission, with the goal of contributing to a more practical and effective assessment strategy for this growing population.

Materials and Methods: This retrospective single-center study analyzed 503 patients aged over 65 who were assessed preoperatively by cardiology for cardiac risk stratification between June 2023 and June 2024. We assessed the relationship between three cardiac risk indices – cardiologist-determined risk, revised cardiac risk index (RCRI), and geriatric cardiac risk index (GSCRI) – with in-hospital mortality and ICU admission.

Results: A cardiologist's risk assessment revealed no significant ability to predict mortality, with an area under the curve (AUC) of 0.564. In contrast, both the RCRI and the GSCRI showed significant predictive ability, each with an AUC of 0.677. All three cardiac risk indices demonstrated significant effectiveness in distinguishing patients who may require admission to the ICU.

Conclusion: Pre-operative evaluation of the elderly with GSCRI could guide a perioperative patient management plan and predict prognosis, without an overuse of cardiac consultation.

Keywords: Cardiovascular risk assessment, Elderly, Geriatric sensitive cardiac risk index, In-hospital mortality, Intensive care, Revised cardiac risk index

Cite this article as: Caliskan B, Guldal G, Seker B, Turk S, Aydin B, Besir Z. Pre-Operative Cardiac Risk Assessment to Predict Mortality and Intensive Care Admission in Elderly Patients Scheduled for Non-Cardiac Surgery: Comparison of The Revised Cardiac and Geriatric Sensitive Cardiac Risk Indices With Cardiology-Determined Risk. Eur Arch Med Res 2025;41(4):246–252.

Address for correspondence: Berna Caliskan. Department of Anesthesiology and Reanimation, Haseki Training and Research Hospital, Istanbul, Türkiye

E-mail: caliskan.b@gmail.com **ORCID ID:** 0000-0002-4519-7762

Submitted: 01.07.2025 **Revised:** 27.08.2025 **Accepted:** 28.08.2025 **Available Online:** 20.10.2025

European Archives of Medical Research – Available online at www.eurarchmedres.org

INTRODUCTION

The perioperative management of cardiovascular disease (CVD) and its complications in patients undergoing non-cardiac surgery has been a focus of research to establish guiding recommendations. Studies indicate that even patients aged 45 and older who undergo in-hospital surgery experience major adverse cardiac events (MACE) in approximately one out of every 33 surgical admissions.[1] As elderly patients are often at greater risk for cardiovascular problems or developing post-operative CVD, pre-operative evaluation to stabilize or manage these issues presents a more challenging task. Evaluating pre-operative cardiovascular risk indices is recommended to anticipate MACE and mortality.[2] However, there is insufficient evidence to endorse one index over another, especially for elderly patients. This assessment is crucial for optimizing a perioperative plan, which may include determining the need for intensive care admission.

The revised cardiac risk index (RCRI) is a tool that evaluates the risk of cardiac complications and mortality within 30 days of surgery using six variables.[3] A score of 3 or higher is associated with a higher risk of mortality, as shown in various studies.[4] Although it may also predict 1-year mortality, its effectiveness in those over 65 years old is still unclear, except in age-adjusted studies.[5] Thus, the geriatric cardiac risk index (GSCRI) was developed and validated, proving to be a more effective predictor of 30-day mortality in elderly patients undergoing non-cardiac surgery.[6] However, the impact of each index on the perioperative patient plan, including the need for post-operative intensive care unit (ICU), has not been examined in practice based on the identified risk. Moreover, in elderly patients with high cardiac risk, pre-operative cardiology consultation is often requested, and post-operative ICU follow-up is planned according to the risk indicated by cardiology for possible post-operative adverse effects. Cardiologists' assessment of risk, although based on the same guideline, may not align with anesthesiologists' evaluations that utilize risk indices such as RCRI and GSCRI in predicting mortality and the risk for post-operative ICU admission.[2] The risk stratification of a cardiologist primarily relies on patient characteristics, such as a history of CVD, functional capacity assessment, and transthoracic echocardiography results, rather than the extent and timing of surgery.

In this study, we examined the associations of RVRI, GSCRI, and cardiologist-determined risk with in-hospital mortality, the need for post-operative intensive care, and long-term hospitalization in elderly patients undergoing non-cardiac surgery.

MATERIALS AND METHODS

Study Design and Patient Selection

This retrospective cross-sectional cohort study was conducted at a tertiary-care teaching hospital following approval from our Institutional Ethical Committee (approval number: 57-2024, date: August 1, 2024). We reviewed the records of 607 patients who received pre-operative cardiology consultations between June 2023 and June 2024 from the hospital database. Finally, we included 503 individuals aged 65 years and older who were admitted for elective non-cardiac, non-vascular surgery and had a pre-operative cardiology consultation just because of general evaluation, either for a known chronic cardiac comorbidity or because of anticoagulation management. The exclusion criteria included patients with an American Society of Anesthesiologists (ASA) grade of V or VI, those who experienced a major cardiac event during pre-operative preparation, individuals who had significant intraoperative bleeding that required a blood transfusion, patients who underwent more than one operation during their hospital stay, and files that contained incomplete data. Patient data confidentiality was fully maintained, and the information was utilized solely for research purposes. This study was conducted in accordance with the Helsinki Declaration, and the requirement for informed consent was waived due to the retrospective design of the study.

Clinical Data and Outcome Variables

Demographic variables (age, gender, and ASA score) and clinical characteristics of patients, including smoking status, anticoagulation use, and ejection fraction (EF), written in the cardiology consultation just before the surgery, were noted. Surgical type is classified not by the procedure but by the surgical risk level as minor, moderate, and major, as it is more relevant for cardiac risk stratification. The type of anesthesia was classified as general regional anesthesia, which included spinal and combined spinal epidural anesthesia.

The primary outcome variables of the study are risk assessed by the cardiologist as low, intermediate, or high, determined just before the surgery in the consultation; RCRI and GSCRI were calculated from the medical data received at pre-operative anesthesia evaluation. We also calculated the Charlson comorbidity index (CCI) as an independent estimation of the survival rate. Secondarily, we questioned the hospitalization data as to the length of hospital stay, especially extended hospitalization, which is defined as more than 21 days, the type of discharge in search of in-hospital mortality, and the need for ICU admission from the hospital system.

Statistical Analysis

Descriptive statistics of the data included mean, standard deviation, median, minimum, maximum, frequency, and ratio values. The distribution of the variables was assessed using the Kolmogorov–Smirnov and Shapiro–Wilk tests. To analyze quantitative independent data with a non-normal distribu-

tion, the Mann–Whitney U test was employed. The Chi-square test was used for analyzing qualitative independent data. The impact of various factors was examined through univariate and multivariate logistic regression. The effect size and cutoff value were determined using the receiver operating characteristic curve. Statistical analysis was conducted using SPSS version 27.0.

RESULTS

The demographic and clinical characteristics of 503 patients indicated that the majority were male, ASA III patients undergoing major surgery, primarily under general anesthesia (Table 1).

The cardiologist assessed the cardiac risk of the population, categorizing most individuals as low risk. The RCRI primarily indicated a Class 2 risk, whereas the GSCRI revealed mostly a Class 3 risk (Table 2). Furthermore, the mean CCI score in the study population corresponded to a nearly 50% reduction in the estimated survival rate. The median length of hospital stay was 13 days, and most of the patients were discharged within 21 days (Table 2). Notably, 61.6% of them were admitted to the ICU.

The mortality rate was found to be 22.7% as 93 patients were deceased, and 410 patients were alive. In the multivariate model, significant independent efficacy of gender, general anesthesia, RCRI index, GSCRI index, and EF values were observed in differentiating between patients with and without exitus (p=0.008, 0.012, 0.027, 0.00, 0.008). Cardiologist-determined risk showed no significant efficacy in discriminating mortality with an area under the curve (AUC) of 0.564 (0.494–0.635) (p=0.053). However, RCRI and GSRI showed significant efficacy in discriminating mortality with an AUC of 0.677 (0.614–0.740) and 0.677 (0.613–0.740) (p=0.00, p=0.00), respectively (Fig. 1).

The ASA score, the percentage of general anesthesia, and major surgery were significantly higher in the group that required ICU admission (p=0.00, 0.00, and 0.00).

Table 1. Demographic and clinical characteristics of patients

Variable	Min–Max	Median	Mean±SD/n (%)
Age (years)	65.0–99.0	73.0	74.4±6.9
Gender			
Female			229 (45.5)
Male			274 (54.5)
ASA score			
I			5 (1.0)
II			212 (42.1)
III			222 (44.1)
IV			64 (12.7)
Smoking status			
Non-smoker			134 (26.6)
Former smoker			357 (71.0)
Current smoker			12 (2.4)
Type of anesthesia			
General			405 (80.5)
Regional			98 (19.5)
Surgical risk level			
Major			229 (45.5)
Moderate			121 (24.1)
Minor			153 (30.4)
Ejection fraction (EF, %)	20.0–65.0	55.0	53.3±8.7
Anticoagulant use			
No			255 (50.7)
Yes			248 (49.3)

ASA: Society of Anesthesiologists.

Table 2. Cardiac risk assessment and hospitalization data

Variable	Min–Max	Median	Mean±SD/n (%)
Risk assessed by cardiologist			
Low risk			241 (47.9)
Intermediate risk			184 (36.6)
High risk			78 (15.5)
Revised cardiac risk index (RCRI)	0.0–5.0	1.0	1.4±1.1
Geriatric sensitive cardiac risk index (GSCRI)	0.0–73.9	0.3	1.7±4.8
Charlson comorbidity index (CCI score)	2.0–12.0	4.0	4.7±1.8
ICU admission			
Yes			139 (27.6)
No			363 (72.2)
Hospital stay >21 days			
Yes			139 (27.6)
No			363 (72.2)
Length of hospital stay (days)	1.0–143.0	13.0	19.6±21.4 (27.6)
Discharge type			
Discharged home			395 (78.5)
Transferred			14 (2.8)
Exitus			93 (18.5)

ICU: Intensive Care Unit.

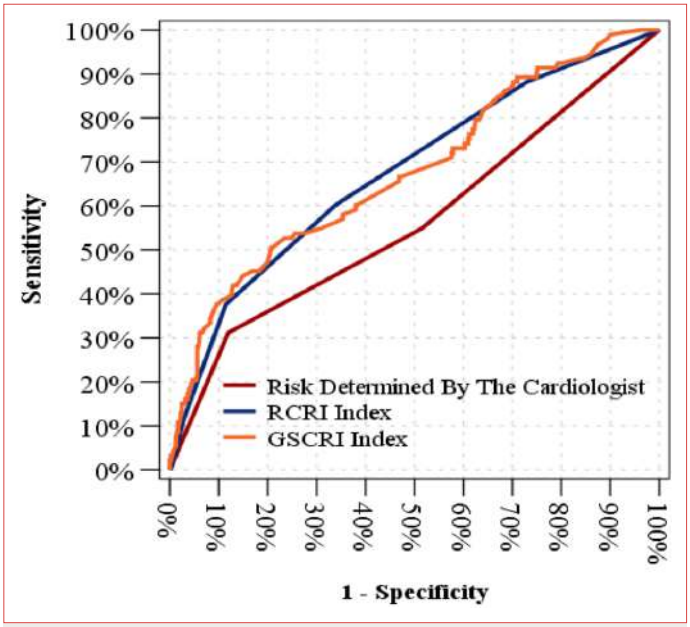


Figure 1. Receiver operating characteristic curves of cardiac risk indices in relation to mortality.

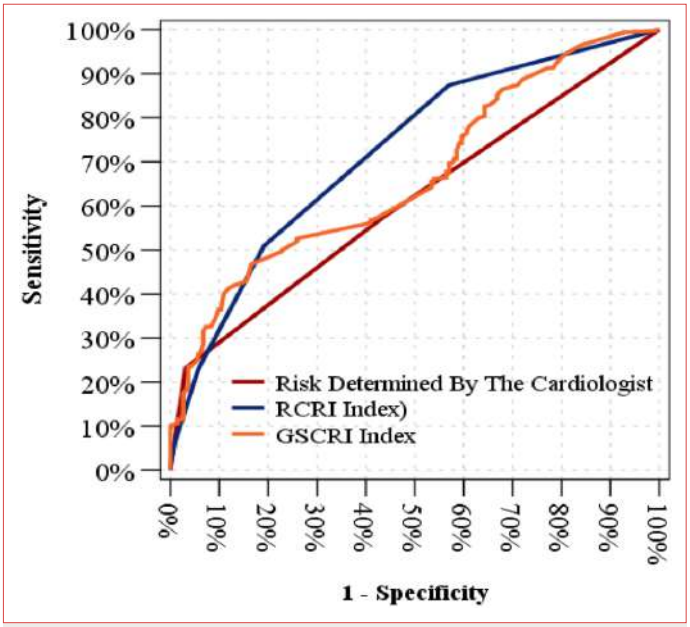


Figure 2. Receiver operating characteristic curves of risk indices in relation to intensive care unit admission.

In the multivariate model, significant independent efficacy of anesthesia type, major surgery, cardiologist-determined risk, RCRI index, GSCRI index, CCI score, and EF value was observed in differentiating patients with and without ICU admission (p=0.00, 0.00, 0.001, 0.022, 0.002, 0.008, and 0.013). All three cardiac risk indices showed significant efficacy in discriminating possible ICU admission (AUC=0.611, 0.722, and 0.668) (Fig. 2).

DISCUSSION

In this study, we focused on the relation of RCRI and GSCRI, along with cardiologist-determined risk, in predicting patient prognosis for the elderly. Our goal was to determine a practical but reliable perioperative cardiac risk management for the elderly carried out by anesthesiologists and compare the effectiveness between cardiology assessments and the risk indices to predict in-hospital mortality, the need for post-operative intensive care, and long-term hospitalization. Our findings indicate that these risk scores are significantly more effective in predicting in-hospital mortality rates for elderly patients. Furthermore, we have shown that when it comes to the need for post-operative ICU, it is not necessary to rely solely on cardiology assessments. Instead, planning based on the RCRI and GSCRI is both sufficient and adequate.

We specifically selected patients who required cardiology consultation for general evaluation, and most of them requested anticoagulant management regardless of the extent of surgery. Nevertheless, reasons for a pre-operative cardiology consultation may include low exertional capacity, the need to optimize the treatment of patients showing signs of heart failure, rhythm abnormalities, and evaluation of a newly identified murmur.[7] In the elderly population, mobility is often limited due to joint diseases, which means that low exertional capacity unrelated to cardiac issues may not accurately reflect risk. For this reason, we did not include the metabolic equivalents (METs) assessment in our study, as it could be misleading, especially since nearly all these patients had a METs score lower than four. Our findings indicated that neither anticoagulant use nor EF was associated with mortality or the need for ICU admission. None of our patients underwent further stress testing, and, in fact, the literature has not found any association between pre-operative stress testing and a reduction in post-operative MACE as well.[8,9] Therefore, a pre-operative evaluation with RCRI and especially GSCRI could guide a perioperative patient management plan according to risk stratification without an overuse of cardiac consultation.

When or why pre-operative cardiology consultation is necessary is an ongoing debate. In the study of Groot et al.,[7] most referrals to a cardiologist were found to be for evaluating valve abnormalities, and the cardiologist made no changes to the treatment plan, with the most significant outcome of the cardiac consultation being a delay in surgery. All of the consultations in our case were conducted for a general evaluation, either due to a known chronic cardiac condition or for anticoagulation management. The only outcome from these consultations was the decision to reserve the ICU for a high-risk patient who was scheduled for even a minor surgery. In

fact, as our results show, risk indices can help us make a more accurate prediction of the need for ICU even without a cardiology evaluation. Our finding indicates that the risk assessment determined by cardiology does not predict mortality; however, it does have consequences for ICU admission. Specifically, patients who do not actually require ICU admission might still be reserved for it due to a high-risk assessment made by the cardiologist. As a result, they may end up being admitted to the ICU when it is unnecessary. This situation contributes to increased workload for the hospital and imposes a financial burden on the healthcare system, consistent with other studies in the literature.[10] Reducing low-value cardiovascular care is a current issue prioritized by the American Heart Association Council on Quality of Care and Outcomes.[11] It is defined basically as health care services providing no benefit for the patient and also having the possibility of leading to preventable morbidity and mortality, such as unnecessary ICU admission, in the spotlight of this study. To prevent this, Atar et al.[12] investigated the use of pre-operative risk scores in requesting consultation and found that the Gupta score reduced pre-operative cardiac consultation and diagnostic tests, which in turn reduced operative time and even ICU stays. However, the Gupta score does not include comorbidities other than the creatinine level, which is highly related to prognosis for the elderly.[6]

This study selected RCRI for the investigation as it is widely accepted and recommended, ensuring a common language among various subspecialties such as surgeons, cardiologists, and anesthesiologists.[13] RCRI >1 is associated with increased risk of major cardiac events and also shown to be associated with increased post-operative mortality.[2,14,15] Moreover, patients with an RCRI score of 1 or greater were found to be related to prolonged hospital stays.[16] Meanwhile, the higher percentage (72.2%) of our study population did not have a prolonged hospital stay. In studies like this one, where the type of surgery was not analyzed separately, the relationship between a high RCRI and prolonged hospitalization may not be clearly demonstrated. Furthermore, recent studies have raised questions about the limitations of RCRI, particularly in the elderly population, and have explored the development of newer models that are more sensitive in detecting myocardial injury after surgery.[17] The mean CCI and RCRI values in our patient group also showed the presence of comorbidities, and the elderly group had higher CCI values but lower RCRI values. CCI predicts long-term mortality and needs a different scoring system than RCRI to predict short-term prognosis, as in our patient group.

The GSCRI, developed to more accurately determine surgical and cardiac risk in elderly patients, was found to be more reliable than the GUPTA MICA and RCRI with an AUC of 0.76 in initial validation studies.[6] When the association of GSCRI with post-operative MACE in the elderly population in non-cardiac vascular surgeries was examined, the AUC was 0.73, again more sensitive than RCRI, but it did not exceed the limit of 0.80 as in our study, and they augmented its sensitivity by adding NT-proBNP as a biomarker to GSCR.[18] What distinguishes the GSCRI from the RCRI is that it considers stroke history and functional status assessment. This is important due to the high incidence of stroke in this age group and the prevalence of frailty, which can lead to mobilization deficits that impact patient prognosis. Recently, frailty has emerged as a crucial factor in decision-making for non-cardiac surgeries.[19] Additionally, when frailty is combined with the RCRI, it is more effective at predicting perioperative myocardial injury than the RCRI alone.[20] This may be why the GSCRI is more sensitive than the RCRI in relation to in-hospital mortality and ICU admission, as reflected in our results. The new guideline on cardiovascular management in non-cardiac surgery, published in 2024, essentially recommends estimating the risk of MACEs with a risk calculator without specifying the RCRI or any other single index, as in the previous one, and emphasizes risk modifiers such as frailty and recent stroke in a completely new approach.[21]

For these reasons, this study examined the GSCRI and found it to be relatively superior to the RCRI. However, as our study examined the elderly defined as 65 years and older, a subgroup analysis was done in 80 years and older, defined as the oldest old, may not have the same results as Fayed et al.[22] revealed, limited predictive ability of in-hospital MACE and post-operative ICU admission, both for RCRI and GSCRI. Nevertheless, it should be noted that when both risk scores are updated with additional variables such as age, AF, and trauma surgery, the predictability and clinical usefulness of the GSCRI are shown to increase, while the RCRI remains limited.[22]

Technology is making significant contributions to the healthcare system, particularly through the development of electronic form systems aimed at reducing the number of cardiology consultations needed for cardiac risk assessments.[23] Researchers are also focusing on developing machine learning algorithms combined with risk indices for assessing risks associated with non-cardiac surgeries.[24] This area will be the primary focus of future research efforts.

Limitations

Our study has several limitations. First, its retrospective and single-center design limited our ability to collect additional variables that could enhance prognostication and predictive value for this population. For instance, incorporating pre-operative frailty indices would be beneficial. Furthermore, adding the dukes' activity score could help correlate frailty and functional status with their impact on in-hospital mortality and the GSCRI. Assessing cognitive function scores may also

have clinical significance and could broaden research opportunities, particularly for the elderly.

Although we estimated the hospital burden of cardiac consultations, we were unable to provide a precise calculation. This is especially relevant for patients with a low RCRI or GSCRI who require intensive care due to risks identified by cardiology. We could not determine how long the surgery was delayed due to the unavailability of an ICU.

In this study, we did not specifically evaluate the association of pre-operative risk assessments alone with MACE within 30 days without considering intraoperative data, as many variables, such as tachycardia, hypotension, anemia, duration of surgery, and type of anesthesia, may be associated with MACE.[20] However, the focus of the study is the pre-operative guidance of risk indices, and to our knowledge, it is the only study in the literature evaluating a comparison of the relation of pre-operative cardiologist-determined risk evaluation and anesthesiologist-determined risk indices on in-hospital mortality and post-operative ICU admission.

CONCLUSION

Predicting post-operative outcomes, especially in elderly patients, is highly effective in determining perioperative patient management. In cases where cardiology consultation is not required, pre-operative GSCRI can predict post-operative prognosis and ICU needs. In this way, proper utilization of hospital resources and necessary precautions in patient management can be ensured. In future studies, a new risk stratification model, augmented by the addition of frailty and cardiac markers, could be developed to increase the sensitivity of the GSCRI.

DECLARATIONS

Ethics Committee Approval: The study was approved by Haseki Training and Research Hospital Ethics Committee (No: 57-2024, Date: 01/08/2024).

Informed Consent: Informed consent was waived due to the retrospective design of the study.

Conflict of Interest: The authors declare that there is no conflict of interest.

Funding: The authors received no financial support for the research and/or authorship of this article.

Use of AI for Writing Assistance: Authors state that AI-based language tools (such as ChatGPT) are used solely to improve the clarity and grammar of the article.

Authorship Contributions: Concept – BC; Design – BC; Supervision – BC; Fundings – GG, BS, BA, ST, ZB, BC; Materials – GG, BS, BA, ST, ZB, BC; Data collection &/or processing – GG, BS, BA, ZB, ST; Analysis and/or interpretation – BC; Literature search – BC, GG, BS, BA, ST, ZB; Writing – BC; Critical review – BC, GG, BS, BA, ST, ZB.

Peer-review: Externally peer-reviewed.

REFERENCES

1. Smilowitz NR, Gupta N, Ramakrishna H, Guo Y, Berger JS, Bangalore S. Perioperative major adverse cardiovascular and cerebrovascular events associated with noncardiac surgery. JAMA Cardiol 2017;2:181–7.
2. Writing Committee Members; Thompson A, Fleischmann KE, Smilowitz NR, de Las Fuentes L, Mukherjee D, et al. 2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM guideline for perioperative cardiovascular management for noncardiac surgery: a report of the American College of Cardiology/American Heart Association Joint Committee on clinical practice guidelines. J Am Coll Cardiol 2024;84:1869–969. Erratum in: J Am Coll Cardiol 2024;84:2416.
3. Duceppe E, Parlow J, MacDonald P, Lyons K, McMullen M, Srinathan S, et al. Canadian cardiovascular society guidelines on perioperative cardiac risk assessment and management for patients who undergo noncardiac surgery. Can J Cardiol 2017;33:17–32. Erratum in: Can J Cardiol 2017;33:1735.
4. Hulme RA, Forssten MP, Pourlotfi A, Cao Y, Bass GA, Matthiessen P, et al. The association between revised cardiac risk ındex and postoperative mortality following elective colon cancer surgery: a retrospective nationwide cohort study. Scand J Surg 2022;111:14574969211037588.
5. Hao J, Qian Y, Hou M, Yang Y, Zhou L, Zhang Z, et al. Association of the Revised Cardiac Risk Index with 1-year postoperative mortality: a single-center retrospective study. J Clin Anesth 2025;102:111765.
6. Alrezk R, Jackson N, Al Rezk M, Elashoff R, Weintraub N, Elashoff D, et al. Derivation and validation of a Geriatric-Sensitive Perioperative Cardiac Risk Index. J Am Heart Assoc 2017;6:e006648.
7. Groot MW, Spronk A, Hoeks SE, Stolker RJ, van Lier F. The preoperative cardiology consultation: indications and risk modification. Neth Heart J 2017;25:629–33.
8. Columbo JA, Scali ST, Neal D, Powell RJ, Sarosi G, Crippen C, et al. Increased preoperative stress test utilization is not associated with reduced adverse cardiac events in current US surgical practice. Ann Surg 2023;278:621–29.
9. Ponukumati AS, Columbo JA, Henkin S, Beach JM, Suckow BD, Goodney PP, et al. Most preoperative stress tests fail to comply with practice guideline indications and do not reduce cardiac events. Vasc Med 2024;29:507–16.
10. Oliveira ACC, Schwingel PA, Santos LAD, Correia LCL. The inductor role of cardiac consultation in the pre-anesthetic evaluation of asymptomatic patients submitted to non-cardiac minor and intermediate-risk surgery: a cross-sectional study. Braz J Anesthesiol 2021;71:530–7.

11. Kini V, Breathett K, Groeneveld PW, Ho PM, Nallamothu BK, Peterson PN, et al. Strategies to reduce low-value cardiovascular care: a scientific statement from the American Heart Association. Circ Cardiovasc Qual Outcomes 2022;15:e000105.
12. Atar F, Özkan Sipahioğlu F, Keskin G, Dönmez A. Effect of the gupta score on pre-operative cardiology consultation requests in noncardiac nonvascular surgery. Turk J Anaesthesiol Reanim 2023;51:485–90.
13. Chrisant EM, Khamisi RH, Muhamba F, Mwanga AH, Mbuyamba HT. Assessing the accuracy of the revised Cardiac Risk Index compared to the American Society of Anaesthesiologists physical status classification in predicting Pulmonary and Cardiac complications among non-cardiothoracic surgery patients at Muhimbili National Hospital: a prospective cohort study. BMC Surg 2024;24:263.
14. Nayanar VKN, Prakashbabu UA, Babu MS, Sukesan S, Koniparambil PU, Dash PK. Evaluation of perioperative major adverse cardiac events in patients with coronary artery disease undergoing carotid endarterectomy. Ann Card Anaesth 2025;28:280–6.
15. Boghean A, Guțu C, Firescu D. Perioperative risk: short review of current approach in non cardiac surgery. J Cardiovasc Dev Dis 2025;12:24.
16. Naidu K, Kajee N, Naidu J, Wadee B. Preoperative risk factors for extended hospital stay: a prospective study in a South African clinic. Afr J Prim Health Care Fam Med 2025;17:e1–10.
17. Cicek V, Babaoglu M, Saylik F, Yavuz S, Mazlum AF, Genc MS, et al. A new risk prediction model for the assessment of myocardial ınjury in elderly patients undergoing non-elective surgery. J Cardiovasc Dev Dis 2024;12:6.
18. Perić VS, Golubović MD, Lazarević MV, Kostić TL, Stokanović DS, Đorđević MN, et al. Predictive potential of biomarkers and risk scores for major adverse cardiac events in elderly patients undergoing major elective vascular surgery. Rev Cardiovasc Med 2021;22:1053–62.
19. Amado LA, Wijeysundera DN. Cardiac assessment and management in older surgical patients. Int Anesthesiol Clin 2023;61:1–7.
20. Xi S, Wang B, Su Y, Lu Y, Gao L. Predicting perioperative myocardial injury/infarction after noncardiac surgery in patients under surgical and medical co-management: a prospective cohort study. BMC Geriatr 2024;24:540.
21. Cohn SL. 2024 ACC/AHA guideline on perioperative cardiovascular management before noncardiac surgery: what's new? Cleve Clin J Med 2025;92:213–9.
22. Fayed N, Elkhadry SW, Garling A, Ellerkmann RK. External validation of the revised cardiac risk ındex and the geriatric-sensitive perioperative cardiac risk ındex in oldest old patients following surgery under spinal anaesthesia; a retrospective cross-sectional cohort study. Clin Interv Aging 2023;18:737–53.
23. Kumar M, Wilkinson K, Li YH, Masih R, Gandhi M, Saadat H, et al. Association of a novel electronic form for preoperative cardiac risk assessment with reduction in cardiac consultations and testing: retrospective cohort study. JMIR Perioper Med 2024;7:e63076.
24. Kwun JS, Ahn HB, Kang SH, Yoo S, Kim S, Song W, et al. Developing a machine learning model for predicting 30-day major adverse cardiac and cerebrovascular events in patients undergoing noncardiac surgery: retrospective study. J Med Internet Res 2025;27:e66366.

EAMR 2025 Reviewer List

Adil Turan
Ahmet Alperen Öztürk
Akif Bayyiğit
Ali Safa Balcı
Ali Sarıdaş
Ali Teoman Evren
Ali Yüce
Alpaslan Şahin
Alper Ötünçtemur
Alper Yavuz
Aslı Genç
Aybüke Bacanlı
Bahadır Balkanlı
Bahadır Ermeç
Bedriye Cansu Koyunoğlu
Bekir Eray Kılınç
Berna Basarir
Buğu Usanma Koban
Bülent Karslıoğlu
Burak Çiftçi
Burcu Özcan
Canan Satır Özel
Caner Şahin
Cansel Atinkaya
celal Alandağ
Celil Uğurlu
Çile Aktan
Demet Alaygut
Demet Güneş
Demet Tekdöş Demircioğlu
Deniz Tazeoğlu
Derya Bayram
Didem Cankaya
Dilşad Sindel
Elmas Pınar Kahraman
Enes Efe İş
Enver İpek
Eren Güzeloğlu
Esra Ensari
Esra Nagehan Akyol Önder
Eylem Tarakçı
Eyyüp Danış
Ezel Erşen
Ezgi Hacıhasanoğlu
Ferhat Güler
Gevher Rabia Genç Perdecioğlu
Gizem Köse
Gökay Eken
Gökhan Güven
Gözde Çelik
Gülçin Şimşek
Handan Güleç
Hasan May
Hasan Ulaş
Hatice Demirdağ
Haydar Gök
İbrahim Acır
İbrahim Kaya
İsa Yıldız
İsmail Tüter
Kerem Erkalp
Koray Görkem Sacinti
Mehmet Akça
Mehmet Ali Talmaç
Mehmet Ali Tokgöz
Mehmet Fatih Karakuş
Mehmet Fatih Özkaya
Mehmet Gokhan Culha
Mehmet Hamdi Şahan
Merve Aldıkaçtıoğlu Talmaç
Merve Boyraz
Metin Uzman
Müge Nural Pamukçu
Muhammed Furkan Tosun
Muhammed Şakir Calta
Münevver İrem Kök Yılmaz
Münire Babayiğit
Murat Ayhan
Murat Çakar
Mustafa Caner Okkaoğlu
Mustafa Erkoç
Nadiye Barış Erem
Nazlı Batar
Necla Dereli
Necmi Cam
Neşe İşcan Ayyıldız
Nevin Hatipoğlu
Nevra Dursun Kepkep
Nilgün Mesci
Niyazi İğde
Nur Soyer
Nuriye Pekcan
Öner Bozan
Orhan Şahin
Osman Köstek
Özcan Kaya
Özge Demir
Özge Keniş Coşkun
Özgecan Gündoğar
Özgür Çakır Kaya
Özgür Katrancıoğlu
Özgür Özdemir
Özlem Polat
Rafet Eren
Rana Terlemez
Resul Çinpolat
Rodi Ertogrul
Rukiye Aslan
Saliha Büşra Aksu
Samet Erinç
Sami Sökücü
Sefa Giray Batıbay
Selim Sayın
Selma Uysal
Semra Tiryaki Demir
Serdar Kılınç
Serdar Sarıtaş
Şeref Emre Atiş
Şeref Kerem Çorbacıoğlu
Sevilay Kök
Suna Aşkın Turan
Tahsin Olgun Bayraktar
Ülkü Sabuncu
Utku Murat Kalafat
Yüksel Uğur Yaradılmış
Yunus İmren
Yusuf Altuntaş
Yusuf Berk Akbaş
Zubeyde Arat Akdoğan