

Research Article

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A cross-sectional study on physicians' laboratory test request behaviors

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Abstract

Objectives: Since laboratory tests are an important component of health expenditures, it is important to understand the factors that cause unnecessary test use and take the necessary precautions in order to control health expenditures. The aim of this study is to determine physicians' views on factors affecting unnecessary laboratory test orders.

Methods: A survey method was used to examine unnecessary laboratory test use from the physician's perspective. The construct validity of the survey, which consists of 28 items, was tested with exploratory factor analysis and a 5-factor structure was reached. The reliability of the survey was tested with the internal consistency coefficient and the Cronbach's alpha coefficient was found to be 0.85. Multivariate regression analysis was used to determine whether physicians' level of agreement with the possible reasons for unnecessary test use differed according to their personal characteristics.

Results: Among the possible reasons for unnecessary test use, the dimension in which the physicians who responded to the survey agreed most was "Risk avoidance and patient demands", and the dimension they agreed least on was "Excessively skeptical and detailed thinking". Regression analyzes determined that physicians' opinions about unnecessary test use varied significantly according to the demographic characteristics of physicians.

This study was derived from Adil Aydođdu's Master thesis titled "Examination of Unnecessary Laboratory Test Requests in a Teaching Hospital".

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Conclusions: The findings obtained as a result of the study are thought to be important for decision makers to understand the factors that cause unnecessary laboratory test use and to take the necessary managerial measures.

Keywords: health economics; hospital management; rational use of laboratory tests; unnecessary laboratory tests; public health

Introduction

Since laboratory tests are frequently used in the diagnosis, treatment and management of diseases [1], tests have an important place in the clinical decisions physicians make for patients [2]. Studies have shown that the impact of laboratory test results on physicians' clinical decisions is 60 % [3].

All countries face the pressure to provide quality healthcare and ensure patient safety while using limited healthcare budgets, while reducing costs and eliminating inefficiencies [4]. On the other hand, it is known that laboratory tests, along with many other resources, are used excessively and carelessly in many different health institutions [5]. In various studies in the literature, there is information that unnecessary laboratory test request rates start from 6 % and reach 67 %. Therefore, controls on unnecessary and excessive use of laboratory tests are becoming increasingly important in the management of rapidly increasing healthcare costs [6–13].

Inappropriate test orders that do not produce any value in diagnosis and disease management cause waste and negatively affect healthcare systems, especially the laboratory budgets of hospitals. Unnecessary testing is actually a much more complex problem than it seems and has implications beyond its economic consequences. The problem that arises due to unnecessary tests not only consumes the valuable time of the physician and the specialist performing the test, but also causes attention to deviate from the correct clinical diagnosis and treatment. Therefore, ensuring the appropriateness of laboratory test orders is important not only for the efficient use of

laboratory resources, but also for the correct diagnosis and treatment to be applied to the patient [14].

In order to prevent unnecessary test use, the real reasons behind doctors' test orders need to be examined. Studies on the subject have shown that the primary reason for unnecessary use of laboratory tests is physicians' concerns about medical liability [8, 10, 15–21]. It is known that factors such as the increasing importance given to patient rights in recent years and the fact that malpractice cases are mostly concluded against physicians are behind the increase in physicians' concerns about medical liability. In addition, reasons such as lack of clinical guidelines and patients' test requests may also be effective in unnecessary test requests. In the national literature, although there have been studies that retrospectively examined the level of unnecessary laboratory test use and revealed the costs of unnecessary use [12, 13, 22, 23] and studies investigating the reasons for requesting tests [24, 25]; it is known that there are no studies examining the differences in physicians' opinions regarding the factors affecting unnecessary test use according to their personal characteristics. In this study conducted to eliminate this gap; it was aimed to determine to what extent physicians are affected by possible factors that lead them to request unnecessary laboratory tests and to reveal whether this varies according to the characteristics of physicians.

Materials and methods

Study design and participants

This cross-sectional study was conducted between 15 October 2019 and 5 March 2020. The study was conducted at Muđla Sıtkı Koçman University Training and Research Hospital, one of the 71 university hospitals in Turkey. The hospital is an affiliate hospital with a bed capacity of 567 and serves approximately 1 million people with 1,801 healthcare professionals.

The population of the research consists of 336 physicians working in departments that require laboratory tests in the hospital. The sample size was calculated as 179 people for a 95 % confidence level. The sample size was distributed to the polyclinics where the physicians worked based on the stratified sampling method. The selection of physicians from each layer (polyclinic) was carried out by systematic sampling method.

Data collection instrument

The survey method was used as a data collection tool in the study. The survey was applied to physicians by face-to-face interview method. The survey took an average of 10 min to

complete. The survey consists of two parts. The first part consists of six questions to determine the characteristics of the physicians participating in the research (the unit they work in, gender, specialization status, total service time, working time in the current institution and previous exposure to malpractice cases). In the second part of the survey, 28 statements were included to determine physicians' opinions about possible reasons affecting unnecessary test orders (Table 1). These statements were obtained from studies on the subject [2, 10, 15–24, 26–53] and qualitative interviews with 10 physicians before the field study. A 5-point Likert scale was used to determine the participants' level of agreement with 28 statements regarding the use of unnecessary tests: 1=Strongly disagree, 2=Disagree, 3=Undecided, 4=Agree and 5=Completely agree.

Validity and reliability of data collection instrument

Content validity and construct validity methods were used to evaluate the validity of the data collection tool. To evaluate the content validity of the survey, the opinions of 8 experts on the subject were consulted via e-mail, and the experts were asked to evaluate each of the 28 statements in the scale according to the options of "1) Applicable", "2) Appropriate but should be corrected", "3) Not suitable". As a result of the feedback obtained from 8 experts in the field, the content validity index (0.85) and content validity rate were calculated, proposition 26 (The family structures in the private lives of physicians cause them to approach patients in a more paternalistic manner and therefore benefit more from diagnostic materials), was removed from the survey because it had a content validity rate of –0.5. Before the survey was applied in the actual field, it was tested on 10 physicians in a different hospital to investigate whether the statements in the survey were understandable. As a result of the pre-application, a statement that was not understood was corrected and the survey was given its final form.

Exploratory factor analysis was used to evaluate the construct validity of the survey. Varimax rotation and principal component analysis methods were used in exploratory factor analysis. As a result of the analysis, as seen in Table 1, it was determined that the 28 statements in the survey revealed a 5-factor structure. The Kaiser-Meyer-Olkin (KMO) test value, which reveals whether the sample is sufficient for analysis, was calculated as 0.788 and it was concluded that the number of samples was sufficient. On the other hand, it was observed that the total explained variance of this structure consisting of five dimensions was 50 % and Bartlett's sphericity test was statistically

Table 1: Exploratory factor analysis findings regarding the survey on possible reasons for unnecessary test use.

	References	F1	F2	F3	F4	F5
27. Fear of lawsuits arising from medical malpractice	[10, 15–21]	0.76				
28. Physicians' thoughts of securing themselves due to the bad situations they experience	[10, 15–21]	0.74				
11. Failure to reject test requests from patients	[15–17, 45]	0.69				
12. Patients evaluate physicians who request more laboratory tests as more caring physicians.	[15, 17, 36, 45]	0.57				
22. Physicians cannot listen to their patients adequately due to their current workload (high number of patients per physician) and therefore try to save time by requesting a test.	[21, 39, 52]	0.55				
17. Fear of uncertainties during the diagnosis of the disease	[10, 42, 52]	0.62				
15. Physicians can request mass testing through panel tests they have created for their own convenience.	[34, 47]		0.74			
16. Ordering many tests without thinking due to work/manual habits	[10, 34, 47]		0.68			
14. The comfort zone that the existence or coverage of the patient's social security provides to the physician and the patient regarding test requests.	[39, 50, 51]		0.60			
13. Physicians act freely when ordering tests due to patients' lack of knowledge about the tests.	[10, 39, 48, 49]		0.68			
18. Physicians do not have sufficient knowledge about the features and use of clinical laboratory tests.	[28, 31, 34, 40, 50, 53]		0.68			
19. Physicians do not have sufficient information about laboratory test costs.	[10, 16, 18, 23, 28, 31]		0.56			
2. Lack of test order procedures that physicians can use as a guide	[10, 16, 28, 30, 34–38]			0.67		
1. Lack of computer-based systems that provide decision support regarding appropriate laboratory test ordering.	[16, 28–33]			0.66		
4. Insufficient training and feedback provided by the hospital management on rational laboratory use	[2, 16, 17, 22, 28, 30, 34, 40, 41]				0.62	
6. The insurance institution obliges the physician to request some relevant tests before making some decisions.	[39]				0.55	
3. Inability to access the test results recently applied to the patient.	[10, 28, 34, 39]			0.56		
5. Pressure from hospital administrators or superiors to use tests	[28, 42]			0.49		
23. Lack of sufficient information exchange between physicians	[19, 28, 43, 49]			0.41		
25. Physicians want to investigate the possible relationship between different tests and the disease and gain experience for subsequent test orders.	[20, 39, 42, 52]				0.74	
26. Even if there is no doubt, the idea that rare diseases such as one in a million can be found	[20, 34, 39, 52]				0.58	
20. Worry about misdiagnosis and embarrassment to colleagues due to diagnosis	[19, 42]				0.49	
21. Physicians try to create a perception among their colleagues or superiors that they have examined the patient in detail	[19, 20, 28, 39]				0.48	
24. The idea that all test results can be meaningful together rather than separately	[34, 39, 52]				0.47	
8. Due to the rapid development of electronic laboratory test order information systems, it has become easier to order and access tests.	[16, 28, 43, 44]					0.69
10. Many tests are routinely requested within the framework of clinical practices	[10, 16, 28, 35, 39, 47]					0.50
7. Advances in modern diagnostic technology	[16, 28, 43]					0.50
9. Contribution of laboratory tests to hospital revolving fund	[24, 39, 45, 46]					0.50
Eigenvalues		21.4	9.0	6.8	6.0	5.6
Explained variance, %		12	12	10	8	8
Cronbach alpha coefficient		0.81	0.78	0.70	0.70	0.55

KMO=0.788; Barlett Test=1,595.74 $p < 0.001$; total explained variance=%50; overall cronbach alpha=0.85.

significant ($\chi^2=1,595.74$; $p < 0.001$). It was observed that the total explained variance value was between 40 and 60 %, which is accepted in social sciences, and the variance explained by each sub-dimension was above 5 % [54, 55].

In naming the factors (dimensions) reached, expressions (items) and studies on the subject were taken into consideration. Factor 1 was named “Risk avoidance and patient demands”; Factor 2 was named “Being relaxed when requesting a test”; Factor 3 was named “Lack of conditions

supporting rational use of testing”; Factor 4 was named “excessively skeptical and detailed thinking” and Factor 5 was named “Easy access to tests”.

The reliability of the answers given to the survey was evaluated with Cronbach's Alpha internal consistency coefficient. Considering the values in Table 1; It was observed that the reliability coefficients of the dimensions were between 0.55 and 0.81, and the general reliability coefficient was 0.85, thus the survey had an acceptable level of reliability [56–58].

Statistical analysis

The data of the study were analyzed using SPSS (Statistical Package for Social Sciences) 26.0 program. Content validity and construct validity methods were used to evaluate the validity of the data collection tool. Literature and expert opinions on the subject were used to evaluate content validity, and exploratory factor analysis was used to evaluate construct validity. The reliability of the answers to the survey was evaluated with Cronbach's Alpha coefficient.

Personal characteristics of the participants' opinions regarding the reasons affecting unnecessary test use ("Risk avoidance and patient demands", "Being relaxed when requesting a test", "Lack of conditions supporting rational use of testing", "Excessively skeptical and detailed thinking" and "Easy access to tests") multivariate regression analysis was used to determine whether it was affected or not.

In regression analyses, five factors related to unnecessary test use ("Risk avoidance and patient demands", "Being relaxed when requesting a test", "Lack of conditions supporting rational use of testing", "Excessively skeptical and detailed thinking" and "Easy access to tests") Average scores were included as dependent variables. In order to determine whether the level of physicians seeing these factors as the reason for unnecessary test use differs according to their personal characteristics, the department in which the physicians work, their gender, specialization status, length of time in the profession and in the current institution, and previous exposure to a malpractice lawsuit were included as independent variables.

Results

Our survey gathered responses from physicians in a university hospital, with roughly half from surgical units and half from internal units. Most participants were female (57.5%), and 41.3% were general practitioners or assistant physicians. Notably, 69.8% had personally encountered a malpractice case or had a relative who did. On average, physicians had 12.9 years of professional experience and 5.3 years at this institution (Table 2).

Table 3 summarizes physicians' opinions on reasons for unnecessary test use, identifying "Risk avoidance and patient demands" as the most agreed-upon factor. Specifically, 78.8% strongly agreed that experiencing negative situations leads physicians to order tests for self-protection (Item 28). Other highly agreed-upon reasons included "Doctors cannot listen to their patients adequately due to their current workload and therefore try to save time by requesting tests"

Table 2: Demographic characteristics of the participants (n=179).

Features	n	%
Department they work in		
Surgical units	88	49.2
Internal units	91	50.8
Gender		
Woman	103	57.5
Male	76	42.5
Specialization status		
Practitioner & assistant	74	41.3
Specialist physician ^a	105	58.7
Facing a malpractice case		
Yes	125	69.8
None	54	30.2
	Mean	SD
Total service time experience	12.9	8.3
Working time in this institution	5.3	4.6

^aConsists of specialist physicians, assistant professors, associate professors and professors.

(Item 22, 75.4% agreement) and "Fear of lawsuits arising from medical errors" (Item 27, 74.9% agreement). Conversely, "Excessively skeptical and detailed thinking about diseases" was the least agreed-upon dimension. The least endorsed specific reasons were "Pressure from hospital administrators or superiors to use tests" (Item 5, 19% agreement) and "The contribution of laboratory tests to the revolving fund" (Item 9, 20.1% agreement).

Table 4 presents models analyzing how personal characteristics influence physicians' opinions on unnecessary test ordering. In the first model, a significant model ($F=6.713$; $p<0.001$) was reached, estimating that physicians' agreement with the view that they use unnecessary laboratory tests due to "risk avoidance and patient demands" varies according to their personal characteristics. The explanatory coefficient (R^2), of the model shows that 11.7% of the variance in physicians' opinions on this dimension is explained by their personal characteristics. The explanatory coefficient (R^2), of the model shows that 11.7% of the variance in physicians' opinions on this dimension is explained by their personal characteristics. The model showed that there were statistically significant relationships between the unnecessary laboratory test order due to "risk avoidance and patient demands" dimension and the unit where physicians work ($p=0.006$); previous encounter with a malpractice lawsuit ($p=0.012$); total study time

Table 3: Participation levels of physicians responding to the survey on possible reasons for unnecessary test use.

	Mean	SD
Risk avoidance and patient demands	3.80	0.82
27. Fear of lawsuits arising from medical malpractice	3.94	1.08
28. Physicians' thoughts of securing themselves due to the bad situations they experience	4.08	0.98
11. Failure to reject test requests from patients	3.53	1.21
12. Patients evaluate physicians who request more laboratory tests as more caring physicians.	3.58	1.23
22. Physicians cannot listen to their patients adequately due to their current workload (high number of patients per physician) and therefore try to save time by requesting a test.	3.94	1.17
17. Fear of uncertainties during the diagnosis of the disease	3.75	1.12
Being relaxed when requesting a test	3.04	0.84
15. Physicians can request mass testing through panel tests they have created for their own convenience.	3.24	1.24
16. Ordering many tests without thinking due to work/manual habits	3.07	1.28
14. The comfort zone that the existence or coverage of the patient's social security provides to the physician and the patient regarding test requests.	3.32	1.17
13. Physicians act freely when ordering tests due to patients' lack of knowledge about the tests.	2.77	1.18
18. Physicians do not have sufficient knowledge about the features and use of clinical laboratory tests.	2.52	1.18
19. Physicians do not have sufficient information about laboratory test costs.	3.32	1.23
Lack of conditions supporting rational use of testing	3.13	0.72
2. Lack of test order procedures that physicians can use as a guide	3.31	1.16
1. Lack of computer-based systems that provide decision support regarding appropriate laboratory test ordering.	3.27	1.19
4. Insufficient training and feedback provided by the hospital management on rational laboratory use	3.26	1.14
6. The insurance institution obliges the physician to request some relevant tests before making some decisions.	3.07	1.35
3. Inability to access the test results recently applied to the patient.	3.33	1.24
5. Pressure from hospital administrators or superiors to use tests	2.35	1.17
23. Lack of sufficient information exchange between physicians	3.33	1.24
Excessively skeptical and detailed thinking	2.98	0.80
25. Physicians want to investigate the possible relationship between different tests and the disease and gain experience for subsequent test orders.	2.80	1.08
26. Even if there is no doubt, the idea that rare diseases such as one in a million can be found	2.78	1.27
20. Worry about misdiagnosis and embarrassment to colleagues due to diagnosis	3.09	1.29
21. Physicians try to create a perception among their colleagues or superiors that they have examined the patient in detail	3.00	1.20
24. The idea that all test results can be meaningful together rather than separately	3.25	1.07
Easy access to tests	3.31	0.64
8. Due to the rapid development of electronic laboratory test order information systems, it has become easier to order and access tests.	3.58	1.04
10. Many tests are routinely requested within the framework of clinical practices	3.81	0.95
7. Advances in modern diagnostic technology	3.51	0.99
9. Contribution of laboratory tests to hospital revolving fund	2.36	1.19

($p < 0.001$); and working hours in the institution ($p = 0.041$). When the model is examined closely; It has been found that physicians working in internal units, physicians who have previously faced malpractice lawsuits, physicians with shorter total service time, and physicians with longer tenure in this institution are more likely to agree with the view that unnecessary tests are requested due to "risk avoidance and patient demands".

In the second model in Table 4, A significant model ($F = 5.559$; $p = 0.020$) predicted agreement with "Being relaxed when requesting a test," though it explained only 2.6 % of the variance. Agreement with this factor significantly varied by unit of work ($p = 0.020$), with internal unit physicians agreeing more than surgical unit physicians.

In the third model, a significant model ($F = 3.782$; $p = 0.012$) was reached predicting physicians who said they wanted unnecessary laboratory tests due to "lack of conditions supporting rational use of testing". This significant model ($F = 3.782$; $p = 0.012$) explained 4.6 % of the variance, mainly by total service time ($p = 0.031$) and institutional tenure ($p = 0.014$). Agreement with this factor also significantly varied by unit of work ($p = 0.063$, at 0.10 error level). Physicians with shorter total service time and longer institutional tenure showed greater agreement with this factor (lack of conditions supporting rational use of testing).

In the 4th model in Table 4, A significant model ($F = 4.125$; $p = 0.001$) explained 8.1 % of the variance in agreement with "Excessively skeptical and detailed thinking." Significant

Table 4: Examination of physicians' views on the factors affecting unnecessary laboratory test use by their personal characteristics.

	Risk aversion and patient demands		Being relaxed when requesting a test		Lack of conditions supporting rational use of testing		Excessively skeptical and detailed thinking		Easy access to tests	
	St. Beta ^a	Sig.	St. Beta	Sig.	St. Beta	Sig.	St. Beta	Sig.	St. Beta	Sig.
Unit of study (<i>Ref: Surgery</i>)	0.207	0.006	0.177	0.020	0.139	0.063	0.149	0.042	0.186	0.014
Gender (<i>Ref: Female</i>)							0.129	0.077		
Specialization status (<i>Ref: Practitioner</i>)							-0.151	0.043		
Encountering a malpractice case (<i>Ref: Yes</i>)	-0.185	0.012					-0.224	0.003		
Total working time	-0.423	<0.001			-0.208	0.031				
Working time in this institution	0.189	0.041			0.237	0.014	0.137	0.063		
Adjusted R square	%11.7		%2.6		%4.6		%8.1		%2.9	
F	6.713		5.559		3.782		4.125		6.172	
p	<0.001		0.020		0.012		0.001		0.014	

^aStandardized beta coefficient.

differences were observed based on unit of work ($p=0.042$), level of expertise ($p=0.043$), and previous malpractice exposure ($p=0.003$). Physicians in internal units, general practitioners, and those with prior malpractice lawsuits were more likely to agree. Additionally, significant differences (at 0.10 error level) were found by gender ($p=0.077$) and institutional tenure ($p=0.063$).

In the 5th model in Table 4, a significant model ($F=6.172$; $p=0.014$) was reached predicting physicians who agreed that “easy access to tests” was the reason for requesting unnecessary laboratory tests. The explanatory coefficient of the model shows that only 2.9 % of the variance in the dependent variable is explained by the department in which the physicians work. According to the model, the opinion that unnecessary laboratory tests are requested due to “easy access to tests” is higher among physicians working in internal units than among physicians working in surgical units.

Discussion

This study evaluated factors contributing to unnecessary laboratory test use among physicians at a university hospital. We identified five key factors: “Risk avoidance and patient demands,” “Being relaxed when requesting a test,” “Lack of conditions supporting rational use of testing,” “Excessively skeptical and detailed thinking,” and “Easy access to tests.” “Risk avoidance and patient demands” was the most influential factor, indicating physicians often order more tests to ensure safety and prevent patient complaints.

Physicians with shorter total working hours most frequently cited “Risk avoidance and patient demands” as a

cause for unnecessary test orders, followed by those in internal units, those with longer institutional tenure, and physicians with a history of malpractice. Our findings show that as professional experience increases, physicians' tendency to attribute unnecessary test requests to “Risk avoidance and patient demands” decreases. This aligns with literature suggesting experienced physicians make fewer medical errors and use resources more efficiently [38, 59, 60]. This suggests that with increased experience, physicians' anxieties about risk and patient demands lessen, leading them to rely more on their own knowledge than patient influence. Conversely, new physicians may order more tests due to fear of errors [50, 61, 62]. Consistent with other studies, malpractice concerns and fear of being reported were significant drivers of unnecessary testing [63–65]. However, unlike some literature suggesting academic physicians order more tests to avoid reputational loss [20, 66–71], our study found no variation in agreement with “Risk avoidance and patient demands” based on expertise or gender.

We found physicians in internal units were significantly more likely to attribute unnecessary test requests to “Being relaxed when requesting a test” than those in surgical units. This likely stems from higher patient density and test utilization in internal medicine, which typically involves more blood tests [66, 72, 73]. High patient volume and reliance on blood tests for diagnosis allow internal medicine physicians to feel more comfortable ordering tests. The absence of restrictive factors, routine requests, and ease of manual ordering also contribute to this. Being a public hospital further eases financial barriers for patients and physicians regarding test orders.

Our analysis revealed that as physicians' total service period decreased, but their institutional tenure increased, so did their tendency to cite "Lack of conditions supporting rational test use" as a reason for unnecessary test requests. This dimension includes issues like absence of computer-based orders, lack of clear procedures, inability to access recent test results, insufficient training and feedback, external pressures, mandatory test orders, and poor inter-physician information exchange. As physicians' institutional experience grows, they appear to become more aware of and sensitive to these systemic deficiencies. This difference likely reflects accumulated professional knowledge: as physicians gain more experience, they better identify systemic shortcomings. A significant portion of our study participants (57.6 %) had less than 4 years of institutional tenure, with 90.2 % of those also having less than 5 years of medical practice. This direct correlation between professional experience and institutional tenure means that as physicians mature professionally and spend more time in a given institution, they more accurately identify and perceive the lack of conditions supporting rational test use.

Finally, physicians with a history of malpractice lawsuits, general practitioners, and those in internal units were most likely to agree that "excessively skeptical and detailed thinking" leads to unnecessary test requests. Fear of medical errors is universal among physicians. High sanctions, the arduous litigation process, patient-favoring laws, and a sense of isolation can drive physicians towards less risky practices [63]. This aligns with findings from Miller et al. (2012), showing that physicians who faced lawsuits in the last five years had a greater fear of malpractice claims [64]. Uđrak (2019) similarly reported that prior malpractice encounters significantly increased the fear of lawsuits [65]. Our study supports this by showing physicians with past malpractice experience more strongly agree that unnecessary tests are ordered due to fear of lawsuits. Physician expertise also influences test ordering [28], with many studies linking career concerns to increased test ordering [19, 42, 67]. In university hospitals, where career development is central, physicians may conduct more research and order more tests [39]. In a study they conducted on rational laboratory use and quality of medical care, Peterson and Rodin (1987) reported that "gaining experience in laboratory tests through trial and error" was an important reason affecting test use, especially in training and research hospitals [74]. Contrary to some literature, our study found the lowest average agreement for "excessively skeptical and detailed thinking" (2.98) as a reason for test ordering. This discrepancy may be due to the high proportion of specialist physicians in our sample. While non-specialists (practitioners & assistants) supported the literature's view, specialists expressed negative opinions.

This might be because non-specialists, still in training, have less knowledge and experience regarding test utility and disease relationships. Furthermore, agreement with "excessively skeptical and detailed thinking" significantly differed by gender ($p=0.077$ at 0.10 error level). This supports findings that female physicians tend to order more tests [39, 75–77], possibly due to being more emotional and meticulous in patient interactions [39]. Grytten and Sorensen (2003) confirmed that physician thoughts and beliefs influence diagnosis and treatment [75], and Mast et al. (2007) observed gender differences in diagnosis, treatment, and patient communication, with female physicians showing more nurturing approaches [76]. Veloski et al. (2005) also reported that female physicians performed more breast cancer screenings, suggesting gender-based concerns influence their behavior [77].

Another important finding of the study is that physicians working in internal medicine units cite "easy access to tests" as a reason for requesting unnecessary tests much more than physicians working in surgical units. The most important reason for this is that many tests are routinely requested in internal units and physicians working in internal medicine branches. This may be due to their higher workload. The fact that they encounter more patients may lead internal medicine physicians to order more tests, which increases the risk of doctors ordering more unnecessary tests [20, 25]. On the other hand while the study classified physicians as working in internal and surgical branches, it's important to remember that the highest laboratory test utilization rates in our country are observed in emergency departments and intensive care units. Therefore, limiting the analysis to internal and surgical branches may not fully reflect general test ordering behaviors. This point was also emphasized in the study by Yalçındađ et al. (2024) [78]. In future studies, a more detailed examination of test ordering practices in emergency departments and intensive care units will provide a more comprehensive perspective on physicians' test ordering behaviors.

Our study's data collection coincided with the COVID-19 pandemic, a period profoundly impacting physicians' risk perception and test-ordering behaviors. This unique context requires acknowledging the pandemic's potential influence on our findings for a comprehensive interpretation. During the pandemic, increased diagnostic uncertainty and the need to rule out infection often led to more frequent test ordering. Limitations in physical examination due to personal protective equipment also shifted reliance towards laboratory tests. Beyond individual behavior, surging patient volumes, particularly in emergency and intensive care units, likely inflated overall test utilization, indirectly affecting other departments [79, 80]. Crucially, the COVID-19

pandemic serves as a significant confounding factor for this study. Future research should investigate its long-term effects on test ordering and how these practices normalize post-pandemic.

Conclusion and recommendations

Since the rate of increase in health expenditures is greater than the rate of economic growth in many countries of the world, it is necessary to ensure that the limited health resources available are used rationally. Therefore, identifying factors that cause unnecessary hospitalization, unnecessary procedure/surgery, unnecessary medication (especially antibiotic) use, as well as unnecessary laboratory test use, is extremely important to control health expenditures.

As a result of this cross-sectional study conducted on physicians working in a university hospital; Among the factors that direct/motivate physicians to request unnecessary laboratory tests, it has been observed that they mostly state that they want unnecessary tests due to “risk avoidance and patient demands” (mean 3.80; SD 0.82), followed by “easy access to tests” (mean 3.31; SD 0.64). It was found that the level of participation of physicians working in internal units, especially in all factors that cause unnecessary test requests, was higher than physicians working in surgical units. It was observed that physicians with a history of malpractice were much more likely to agree with the views that unnecessary tests were used due to “Risk avoidance and patient demands” and “excessively skeptical and detailed thinking”. It was determined that physicians with more tenure in the institution and physicians with less tenure in the profession were more likely to agree with the view that unnecessary tests are requested due to “Risk avoidance and patient demands” and “Lack of conditions supporting rational use of testing”.

The survey results provide a clear understanding of why physicians order unnecessary tests. Findings indicate that the dimension of risk avoidance and patient demands most significantly influences their decisions. A particularly striking result is that the vast majority of physicians (78.8 %) reported ordering unnecessary tests due to their “thoughts of securing themselves in light of bad situations they have experienced.” This highlights the prominent role of defensive medicine in medical practice. Other significant reasons include inability to listen adequately to patients due to current workload and attempting to save time by ordering tests (75.4 %), and fear of lawsuits arising from medical errors (74.9 %). These findings emphasize how heavy workloads and legal concerns contribute to the tendency for physicians to order unnecessary tests. Conversely, physicians showed the least agreement with “excessively skeptical and detailed

thinking about diseases” as a reason for unnecessary test use. Furthermore, factors such as pressure from hospital administrators or superiors to use tests (only 19 %) and the contribution of laboratory tests to the revolving fund (20.1 %) were found to have a much smaller impact on the decision to order unnecessary tests. In summary, physicians primarily attribute unnecessary test use to a personal quest for security, demanding work schedules, and patient-centric concerns, while indicating that administrative or financial incentives have a relatively low influence.

In this context, in order for health managers to cope with the problem of unnecessary laboratory test requests, measures need to be developed especially for physicians who work in internal units, have a history of malpractice, have a shorter tenure in the profession, but have a relatively longer tenure in their institution. Since this study was conducted only on physicians working in a university hospital, more comprehensive studies need to be conducted for studies with stronger external validity. In the future, studies could be designed to include universities, the Ministry of Health, and private hospitals to investigate whether physicians' opinions regarding the factors causing unnecessary laboratory test use differ based on hospital ownership. Additionally, to provide deeper insights, future research could incorporate questions about a physician's average daily patient load, whether they work in emergency services or after-hours clinics, and their overall workload intensity. Furthermore, to strengthen future versions or follow-up studies, it would be beneficial to include questions about which specific laboratory tests are most frequently requested unnecessarily. Understanding whether certain types of tests (e.g., routine biochemistry panels, vitamin levels, coagulation profiles, or serological markers) are more commonly overused could provide more targeted insights and guide intervention strategies aimed at improving rational test utilization. On the other hand, another limitation of this study is the relatively low R^2 values in regression analyses. This, limit the model's explanatory power over physicians' test-ordering behaviors. Thus, interpreting these findings requires caution, as they reflect only a partial view of this complex issue. Future research should enhance understanding by incorporating additional variables (e.g., physician attitudes, experience, policies, legal concerns, training) and employing diverse methodologies like observational or qualitative studies, beyond just surveys.

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Informed consent: Physicians who agreed to participate in the study were informed about the study before the survey was administered and their verbal consent was obtained stating that they agreed to participate in the study. Personal permission was provided for the use of data and it was undertaken that the obtained data would not be shared with third parties.

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