RESEARCH ARTICLE

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Evaluation of Doctors' Knowledge of Rational Laboratory Use, a Descriptive Study from Turkey

ABSTRACT

Objective: The effects of health expenditures on the economy of countries have become more evident in recent years. Especially unnecessary and inappropriate laboratory tests increase both the cost and the workload. In this study, it was aimed to evaluate the level of knowledge of physicians about rational laboratory use and procedure for frequently ordered tests in clinical practice.

Methods: This study was planned to be a descriptive study. A questionnaire based on the current circular about 'Rational Laboratory Use' and including sociodemographic data was applied to physicians working at Turgut Ozal Medical Center.

Results: The questionnaire was applied to a total of 400 physicians working in internal medicine and surgical branches. The average age of the physicians was 33.01 ± 5.97 (min = 22, max = 59) years. The question about order period of blood lipids was answered correctly by 3.3% of physicians, HbA1c by 80.8%, Urea / creatinine by 64.5%, and vitamin D and vitamin B12 was answered by 40% of physicians. On the other hand 85.3% of the physicians were not aware of the rational laboratory test ordering procedure and 94% had not received any training on rational laboratory use.

Conclusions: It was found that physicians had insufficient knowledge about rational laboratory use and they did not receive any training about the test procedures. In order to reduce health expenditures, more training on this subject should be organized for physicians and awareness should be raised.

Keywords: Rational Laboratory Use, Unnecessary Test Order, Test Order Period.

Doktorların Akılcı Laboratuvar Kullanımı Bilgilerinin Değerlendirilmesi, Türkiye'den Tanımlayıcı Bir Çalışma

ÖZET

Amaç: Sağlık harcamalarının ülkelerin ekonomisi üzerine etkileri son yıllarda daha aşikar duruma gelmiştir. Özellikle gereksiz ve uygunsuz istenen laboratuvar tetkikleri hem maliyeti hem de iş yükünü artırmaktadır. Laboratuvarların akılcı kullanılması ve gereksiz test istemlerinin azaltılması için çeşitli düzenlemeler geliştirilmiş olmasına karşın hala bu konuda yetersizlikler bulunmaktadır. Bu çalışmada hekimlerin akılcı laboratuvar kullanımı hakkındaki farkındalıklarını ve klinik pratikte sık istenen testlere ait test istem prosedürü hakkındaki bilgi düzeylerini ölçmek amaçlandı.

Gereç ve Yöntem: Tanımlayıcı olarak planlanan çalışmada Turgut Özal Tıp Merkezi'nde çalışmakta olan hekimlere 'Akılcı Laboratuvar Kullanımı' hakkında mevcut olan genelge baz alınarak hazırlanan sorulardan ve sosyodemografik verilerden oluşturulan anket formu uygulandı.

Bulgular: Dahili ve cerrahi branşlarda toplam 400 hekime anket uygulandı. Hekimlerin yaş ortalaması 33.01±5.97 (min=22, maks=59) yıl idi. Hekimlerin %3.3'ü, kan lipitleri, %80.8'i HbA1c, %64.5'i Üre/kreatinin, %40'ı D vitamini ve B12 vitamini istem periyodu hakkındaki soruyu doğru yanıtladı. Hekimlerin %85.3'ü akılcı laboratuvar test istem prosedüründen haberdar değildi ve %94'ü akılcı laboratuvar kullanımı ile ilgili herhangi bir eğitim almamıştı.

Sonuç: Hekimlerin akılcı laboratuvar kullanımı hakkındaki bilgi düzeyleri yetersiz olduğu ve testlerin istem prosedürü hakkında eğitimlerinin olmadığı bulundu. Sağlık harcamalarını azaltabilmek için bu konuda hekimlere eğitimler düzenlenmeli ve farkındalık oluşturulmalıdır.

Anahtar Kelimeler: Akılcı Laboratuvar Kullanımı, Gereksiz Test İstemi, Test İstem Periyodu.

INTRODUCTION

Although physical examination and taking anamnesis are the basis in the diagnosis of diseases, many laboratory tests have gained an important place in the diagnosis, thanks to the developing technology. In a study, it was reported that the results of laboratory tests have a two-thirds effective role in the clinical decision making process (1). Currently, the importance of laboratory tests in clinical decision making is indisputable. However, a certain amount of time is needed to conduct all these laboratory tests and to get results. This need comes with an additional cost and increased workload. Besides the contribution of new analyzes with faster turnaround times, brought by technological advances; due to reasons such as an increase in the number of elderly and patients with chronic diseases, and physicians' concerns about malpractice, the number of tests studied in clinical laboratories have been increasing (2,3).

Sometimes, physicians may request more than necessary laboratory tests, which have an important place in clinical decision making. The reasons for this situation, include physicians' anxiety due to legal responsibilities at the stage of clinical decision making, the large number of the patients, the lack of time dedicated for patients, and difficulty in making decisions (4). It has been reported that between 7.5% and 30% of the tests studied in the laboratory constitute repeated and unnecessary tests (5). Ordering inappropriate and extra tests by clinicians leads to a significant increase in costs and workload on health expenses. Increasing workload may cause delays in finalization of laboratory tests and increase in laboratory errors. In health institutions, physicians' unawareness of avoiding unnecessary laboratory tests prevents laboratories from providing services effectively and makes laboratory applications challenging (6).

Given these reasons, many strategies have been developed to use the laboratory studies rationally and effectively, to reduce the inappropriate or unnecessary tests, to manage the increasing demands, and to optimize the clinical use of the tests. The limitation of the number and frequency of laboratory orders is one of these strategies (7). In our country, in recent years, important provisions have been made by the Ministry of Health to ensure rational laboratory use. The "Rational Test Ordering Procedure" has been prepared and communicated to all healthcare providers with a circular, in order to regulate the use of laboratory tests and to reduce the number of unnecessary test orderings. As part of this procedure, a "Test Ordering Period List" was created, which defines the recommended time to re-order the same test after the first order for a patient (8).

In this study, it was aimed to evaluate the awareness of physicians about rational laboratory use and the level of knowledge about the test ordering period for frequently requested tests in clinical practice.

MATERIAL AND METHODS

This study was conducted at Inonu University Medical Faculty Turgut Ozal Medical Center, between April 20 2019 and October 20 2019, with the permission of the Scientific Research and Publication Ethics Committee of Inonu University, dated 07/05/2019 and numbered 2019 / 9-10. All applications within the scope of this descriptive study were carried out in accordance with the latest version of the Helsinki Declaration and the "Good Clinical Practices Directive".

This study included 400 volunteer physicians, 200 from the internal branches, 200 from the surgical branches, in the Inonu University Faculty of Medicine Turgut Ozal Medical Center. Within the scope of the study, a 19-question questionnaire was applied to the physicians who volunteered to participate in the study to evaluate the physicians' level of knowledge about "Rational Laboratory Use". Questionnaire questions were prepared by referring to the "Rational Test Ordering Procedure" issued by T.C. Ministry of Health, General Directorate of Health Services / Research and Diagnosis Services Department with the number of "Procedure No 95966346" (8).

The questionnaire included multiple choice questions regarding the shortest interval required for re-ordering routinely used biochemical parameters and questions investigating whether they were aware of "Rational Laboratory Use", whether they have received training regarding this subject and whether they needed training, and their opinions about restrictions on rational use of laboratories in health policies, as well as demographic data including age, gender, branch, year of working in the profession.

The SPSS version 22.0 statistical packaged software (SPSS 22.0 version, SPSS Inc., Chicago, Illinois, USA) was used for data analysis. Descriptive values were indicated by numbers, percentages, means, and standard deviations. The categorical variables were compared using Chi-square analysis (Pearson Chi-square) between groups. The statistical significance level was accepted as $p<0.05$ in the analyzes.

RESULTS

The average age of the physicians included in the study was 33.01 ± 5.97 (min = 22, max = 59) years. 200 (50.0%) of the participants are women, 200 (50.0%) of the participants are working in the internal branches, and 135 (33.8%) physicians have been working in the profession for 1-5 years. Sociodemographic characteristics of physicians are given in Table 1.

Table 1. Sociodemographic characteristics of physicians

		Mean ± SD	Min-Max
Age		33.01±5.97	22-59
		n	**%**
Gender	Female	200	50.0
	Male	200	50.0
Branch	Internal	200	50.0
	Surgery	200	50.0
Years in profession	0-1 year	43	10.8
	1-5 years	135	33.8
	5-10 years	117	29.3
	>10 years	105	26.3

The number of physicians who were aware of the rational laboratory test ordering procedure was 59 (14.8%), while 24 (6.0%) of them had received rational laboratory training. While 285 (71.3%) physicians stated that they needed training about rational laboratory use, 251 (62.7%) physicians thought that restrictions should be implemented on rational laboratory use, in health policies (Table 2).

Table 2. Physicians' awareness of rational laboratory use

	Yes (n/%)	No (n/%)	No idea (n/%)
Have you received rational laboratory use training?	24 (6.0)	376 (94.0)	-
Are you aware of rational laboratory test ordering procedure?	59 (14.8)	341 (85.3)	-
Do you need rational laboratory use training?	285 (71.3)	46 (11.5)	69 (17.3)
Do you think restrictions should be implemented on unnecessary laboratory use?	251 (62.7)	89 (22.3)	60 (15.0)

The highest number of correct answer was given by the physicians to the question asking the minimum interval for reordering HbA1c with a rate of 80.8% , followed by BUN/Creatinin with 64.5%, CRP with 60.5%, Hepatitis marker test with 59.0%, Vitamin B12 with 41.3%, Vitamin D with 40.8%, AST, ALT with 36.0%, complete urine analysis with 28.0%, with thyroid hormones 17.3%, and Ferritin with 13.5%, whereas only 3.3% the physicians answered the question regarding the minimum interval for blood lipids. The distribution of the answers given by the physicians to the questions evaluating their knowledge about the minimum interval required for re-ordering routinely used biochemical parameters is given in Table 3.

Table 3. Distribution of physicians' answers to questions about the minimum interval required for re-ordering routinely used biochemical parameters

	Correct (n/%)	Incorrect (n/%)	No idea (n/%)
What should be the shortest interval before reordering ferritin?	54 (13.5)	315 (78.8)	31 (7.8)
What should be the shortest interval before reordering complete urine test?	112 (28.0)	243 (60.8)	45 (11.3)
What should be the shortest interval before reordering BUN and creatinin?	258 (64.5)	116 (29.0)	26 (6.5)
What should be the shortest interval before reordering ALT/AST??	144 (36.0)	229 (57.3)	27 (6.8)
What should be the shortest interval before reordering CRP?	242 (60.5)	138 (34.5)	20 (5.0)
What should be the shortest interval before reordering blood lipids?	13 (3.3)	360 (90.0)	27 (6.8)
What should be the shortest interval before reordering Hepatitis marker tests?	236 (59.0)	139 (34.8)	25 (6.3)
What should be the shortest interval before reordering thyroid hormones?	69 (17.3)	307 (76.8)	24 (6.0)
What should be the shortest interval before reordering HbA1c?	323 (80.8)	67 (16.8)	10 (2.5)
What should be the shortest interval before reordering Vitamin B12?	165 (41.3)	202 (50.5)	33 (8.3)
What should be the shortest interval before reordering Vitamin D?	163 (40.8)	192 (48.0)	45 (11.3)

Those whose professional years were between 5-10 years answered the question of ferritin demand interval at the highest rate (p=0.04). The knowing rate of women was found to be significantly higher than men (p=0.038). The rate of knowing this question was found to be significantly higher for those with a 0-1 year professional year (p=0.001). The rate of knowing the CRP examination request interval question in internal sciences was found to be significantly higher than those in surgical sciences (p=0.033). The rate of knowing the question of blood lipids in those who were trained in rational laboratory use was found to be significantly higher than those who did not (p=0.033). The rate of knowing the HbA1c examination request interval question was found to be significantly higher than the others (p=0.014). The rate of knowing the question of Vitamin B12 examination request interval was found to be significantly higher among those in the internal branches than those in the surgery branches(p=0.031) (Table 4).

Table 4. Comparison of physicians' answers to questions about rational laboratory use according to sociodemographic parameters

	Gender		**Branch**		**Years in profession**			
	Female	Male	Internal	Surgery	0-1 year	1-5 years	5-10 years	≥10 years
Ferritin	21 (10,5)	33 (16,5)	20 (10,0)	34 (17,0)	0 (0,0)	14 (10,4)	22 (18,8)	18 (17,1)
p*	0,160		0,089			**0,04**		
Complete urine test	61 (30,5)	51 (25,5)	65 (32,5)	47 (23,5)	12 (27,9)	45 (33,3)	27 (23,1)	28 (26,7)
p*	0,409		0,126			0,149		
BUN and creatinin	137 (68,5)	121 (60,5)	132 (66,0)	126 (63,0)	32 (74,4)	75 (55,6)	81 (69,2)	70 (66,7)
p*	**0,038**		0,806			**0,001**		
ALT/AST	76 (38,0)	68 (34,0)	81 (40,5)	63 (31,5)	11 (25,6)	49 (36,3)	46 (39,3)	38 (36,2)
p*	0,659		0,168			0,453		
CRP	120 (60,0)	122 (61,0)	130 (65,0)	112 (56,0)	24 (55,8)	82 (60,7)	75 (64,1)	61 (58,1)
p*	0,897		**0,033**			0,908		
Blood lipids	5 (2,5)	8 (4,0)	7 (3,5)	6 (3,0)	1 (2,3)	7 (5,2)	3 (2,6)	2 (1,9)
p*	0,691		0,592			0,798		
Hepatitis marker tests	117 (58,5)	119 (59,5)	119 (59,5)	117 (58,5)	25 (58,1)	73 (54,1)	67 (57,3)	71 (67,6)
p*	0,825		0,968			0,518		
Thyroid hormones	34 (17,0)	35 (17,5)	35 (17,5)	34 (17,0)	10 (23,3)	19 (14,1)	20 (17,1)	20 (19,0)
p*	0,912		0,991			0,873		
HbA1c	158 (79,0)	165 (82,5)	158 (79,0)	165 (82,5)	33 (76,7)	122 (90,4)	89 (76,1)	79 (75,2)
p*	0,630		0,643			**0,014**		
Vitamin B12	75 (37,5)	90 (45,0)	91 (45,5)	74 (37,0)	13 (30,2)	56 (41,5)	53 (45,3)	43 (41,0)
p*	0,307		**0,031**			0,499		
Vitamin D	80 (40,0)	83 (41,5)	86 (43,0)	77 (38,5)	10 (23,3)	61 (45,2)	54 (46,2)	38 (36,2)
p*	0,923		0,201			0,068		

Only the percentage of those who answered the Question correctly was taken. *Chi square test.

DISCUSSION

In our study, the rate of physicians who were not aware of the rational laboratory test ordering procedure was 85.3% and only 6% of the physicians reported that they received training about rational laboratory use.

In a survey study 100 physicians were asked whether they have received any training regarding clinical use of the diagnostic tests used in the laboratories and 56 of them answered "Yes" and 44 replied "No". In the same study, 91 out of 100 physicians to the question whether you need training on diagnostic tests and clinical use, used in laboratories (9). In the study of Berkem and Ozbek, 24% of physicians stated that they received training on rational laboratory use, during their specialization education and 12% of physicians stated that they found this training sufficient. In the same study, 91% of physicians stated that they needed training on rational laboratory use (9). In the study conducted by Allan et al., which they evaluated knowledge level of physicians about rational laboratory use and awareness about the test costs, which constitute an important part of the rational laboratory use, it was found that a minority of the physicians (6.7%) received training on this subject (10). In a cross-sectional study conducted by LuísaSá et al, it was reported that only 7% of family physicians had knowledge about test costs. According to this study, Portuguese family physicians were found to have limited awareness of diagnostic use and costs of laboratory tests. In this study, the need for improved training in this area was emphasized (11). In our study, we found that 14.8% of the physicians were aware of the rational laboratory test ordering procedure, only 6.0% of them received rational laboratory usage training, and 71.3% needed training related to rational laboratory use. Although a wide scope training regarding diagnosis and treatment has been provided in the medical education, it is seen that the training for rational laboratory use is insufficient. The results of ours and other studies in the literature show that physicians are not aware of rational laboratory use, do not have sufficient information, do not receive sufficient training on the subject, and there is need for training on this subject.

Physicians generally tend to make laboratory orders based on their past knowledge and habits and the routine practices of the clinics they have been working. Rational laboratory use practices have been obstructed due to the reasons including the effectiveness of education and guidebooks to be less than expected, physicians not wanting to change their habits, understanding of defensive medicine, and insistence of some patients on undergoing more tests. Although it has been shown that, physicians needed to receive training on rational laboratory use, either in our study or in similar studies, the nature and the usefulness of the training that should be provided is still controversial. According to the study conducted by Yeh et al., it was observed that the trainings given to the health professionals working in the clinics were not at the desired rate, and physicians whose impact on health expenditures was reported to be 80%, returned to their old habits of ordering tests, after a certain period (12). It has been shown that training activities for changing physician practices reduce unnecessary laboratory test requests up to 25%, however these reductions are temporary and limited to a certain period of time after training (13). In some studies it has been suggested that replacement of items on the laboratory order forms was more useful than the trainings and its effect lasted longer. Kobkitjaroen et al. reported that they had a 44.2% reduction in unnecessary test orders by replacing the items on the test order form (14).

Unnecessary laboratory test orders have been observed to be more common in training hospitals, since less experienced trainee or resident physicians are responsible for the majority of the test orders in these centers. In another study, it was observed that resident physicians made further and unnecessary orders than specialists, in a training and research hospital, and it was reported that a 50% decrease was achieved when instructors effectively questioned and discussed which tests should be ordered (15). Therefore, by appropriate and accurate trainings and strict follow-up of the applications after these trainings, may reduce unnecessary test orders.

One of the methods developed for rational laboratory use is to limit the test orders. It has been tried to prevent unnecessary tests by restricting the number and frequency of the tests and warning the physicians by the operating system. In our study, 62.7% of the physicians wanted the test orders to be restricted within the scope of rational laboratory practices. Although limiting the test orders has been shown to decrease the number of unnecessary test orders, it should be taken into consideration that such limitations may also limit physicians' effectiveness in terms of diagnosis and treatment. Rather than compulsory restrictions, it should be essential for the physicians to decide depending on their own knowledge and experience and not to order the tests that they cannot interpret (16).

In our study, the highest number of correct answer was given by the physicians to the question asking the minimum interval for reordering HbA1c with a rate of 80.8%, followed by BUN/Creatinin with a rate 64.5%, and CRP with a rate of 60.5%, Hepatitis marker test with 59.0%, respectively. This situation was attributed to the fact that, since these tests have been highly ordered in both internal and surgical branches and the disciplines under them, the physicians have more information about these tests. Again, in our study, the less correctly answered question was about blood lipids, with a rate of 3.3%. This situation was attributed to the

fact that, since evaluating lipid panel is not necessary for most diseases, physicians are less knowledgeable about these tests. In a cohort study conducted by Morgen and Naugler, identified and evaluated inappropriately reordering of six commonly used laboratory tests by using highly specific criteria based exclusively on test repeat time and test value in a population patient sample. The most commonly used tests were identified to include cholesterol, HbA1c, TSH, vitamin B12, vitamin D and ferritin tests. At the end of the study, they found that the rate of tests repeated at 3rd, 6th and 12th months were found to be 11%, 23% and 41%, respectively and it was found that that 16% of these six tests were unnecessarily repeated and represent an extra cost of 0.6 to 2.2 million dollars, per year (13).

According to the Ministry of Health Test Request Period List, Ferritin request should be made at the earliest every 28 days (8). In our study, the rate of those who answered the ferritin demand interval correctly was quite low (13.5%). The knowledge rate of the group with an occupational year of 5-10 years and 10 years or more was found to be significantly higher than the other residents. When this situation was evaluated especially in terms of ferritin, it was attributed to the fact that experienced physicians were more knowledgeable on this subject. In the study of Savaş and Köken, in which they investigated the unnecessary test request in the diagnosis of iron deficiency anemia, it was found that parameters for iron deficiency were requested unnecessarily in approximately 55% of the patients (17).

The HbA1c test is an important blood test for diagnosing diabetes and keeping the disease under control. According to the Ministry of Health Test Request Period List, the HbA1c demand interval should be done at the earliest every 2 months (8). In our study, the HbA1c demand period was known accurately at a rate of 80.8%. This rate was the highest rate obtained in our study. This was attributed to the fact that HbA1c is a specific test and it is frequently requested in the follow-up of diabetes, especially in internal branches. Özdin et al. found that there was a 7.5% decrease in the number of unnecessary HbA1c tests, thanks to the laboratory efficiency committee formed in their study (18).

According to the Test Request Period List of the Ministry of Health, the demand interval of blood lipids should be done every 13 days at the earliest (8). In our study, only 3.3% of the physicians answered the demand period of blood lipids correctly. In their study investigating unnecessary requests for serum lipid tests, Kocatürk et al. found that more than 50% of total cholesterol and HDL tests and nearly 50% of LDL tests were repeated within the first 15 days (19).

The demand period of vitamin D level, which is among the frequently requested examinations, was correctly known by 40.8% of the physicians who participated in our study. 40.13% of the participants got the Vitamin B12 demand period correctly. Vitamin levels are among the most frequently requested examinations in outpatient clinics and are among the tests frequently requested by patients. During routine examinations, requests outside of indications are frequently encountered. In his study, Esendemir found that approximately 10% of vitamin D requests were unnecessary requests, and this rate increased to 34.55% in repeated tests (20).

In our study, only 17.3% of the participants answered the request period of thyroid hormones correctly. In the study conducted by Demirci et al., only TSH test was requested in 4,308 (40.96%) of 8,583 patients for whom thyroid function test was requested, whereas in 4,275 (40.65%) of them, in addition to the TSH test, fT3, fT4 or both fT3 and both fT3 tests were required. They saw that fT4 tests were requested, and according to the results of the first test, they found that the rate of unnecessary tests decreased from 40.65% to 1.19% with the "Reflex test" application, which means a new test request if the criteria are met (21).

Urea, creatinine, AST, ALT, CRP and Complete urine test are not tests specific to a certain disease, but are required in many clinical situations. They are generally considered among routine blood tests and are often requested in panels. For this reason, they are among the tests with a high rate of unnecessary requests. In our study, the rate of accurate knowledge of the request period of these examinations by physicians varies between 36.0% and 64.5%. The fact that there are tests requested by physicians in all branches and that they are highly requested cause the awareness of physicians to be high.

There are some limitations in our study. Since, there are a few studies conducted on the subject of rational laboratory use and these studies were rather cost-effectiveness analyzes than evaluating the level of knowledge of the physicians, the comparability of our findings was limited. However, it was an advantage to be the first study on this regard. Our second limitation is that this study is a descriptive study and cannot be generalized to the universe.

CONCLUSION

In conclusion, in our country, the "Rational Test Ordering Procedure" has been prepared and communicated to all healthcare providers with a circular, by the Ministry of Health, in order to regulate the use of laboratory tests and to reduce the number of unnecessary test orders. Depending on the findings of our study, it was concluded that physicians are not aware of the rational laboratory use principles and they need a comprehensive training about this subject. In addition, it has been seen that the majority of physicians misunderstand the reordering periods of the tests frequently used in

clinical practice. This lack of correct knowledge information leads to an increase in the frequency of unnecessary test orders in clinical practice. In order to reduce health expenditures, trainings should be organized and awareness should be raised on this subject.

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