

PSA TESTİ: YAŞ, CİNSİYET VE COĞRAFİ BÖLGELERE GÖRE KULLANIM, SONUÇLAR VE VARYASYONLAR

PSA TESTING: UTILIZATION, OUTCOMES AND VARIATIONS ACROSS AGE, GENDER AND GEOGRAPHIC REGIONS

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ÖZET

AMAÇ: Bu çalışma, prostat kanseri taraması ve teşhisi bağlamında PSA (Prostat Spesifik Antijen) testinin kullanımını ve sonuçlarını değerlendirmeyi amaçlamaktadır. Çalışma, PSA testinin modellerini, referans aralığını aşma oranlarını ve kanser teşhisleriyle ilişkisini incelemeyi amaçlamıştır.

GEREÇ VE YÖNTEM: 27.146.267 kişiden istenen toplam 148.526.228 PSA testi dahil olmak üzere beş yıllık bir döneme (2017 - 2021) ait veriler analiz edildi. Test sayıları, popülasyon başına test oranları ve referans aralığı aşma oranları cinsiyet, yaş grupları, coğrafi bölgeler ve sağlık kurumu türlerine göre değerlendirildi. PSA testi yapılan kişilerde kanser teşhisi oranları da incelenmiştir.

BULGULAR: Çalışma, PSA testinin sadece erkeklere değil, önemli sayıda kadına da yapıldığını ortaya koymaktadır. Nüfus başına test sayıları ve oranları, farklı yaş gruplarında değişiklik gösterdi ve yaşlı bireylerde daha yüksek oranlar gözlemlendi. Referans aralığını aşma oranları ileri yaş gruplarında en yüksekti. PSA testi yapılan kişilerde kanser teşhisi oranları orta düzeyde bulundu ancak farklı yıllara göre değişiklik gösterdi. Çalışma ayrıca coğrafi bölgelere ve sağlık kurumu türlerine göre test kullanımı ve sonuçlarındaki farklılıkları da vurgulamaktadır.

SONUÇ: PSA testi, prostat kanseri tarama ve tanısında yaygın olarak kullanılmaktadır. Bu çalışmanın bulguları, PSA testi modellerinin, sonuçlarının ve sınırlamalarının kapsamlı bir şekilde değerlendirilmesi gerektiğini vurgulamaktadır. Sonuçlar, farklı popülasyonlarda PSA testinin uygunluğunun ve etkinliğinin daha iyi anlaşılmasına katkıda bulunabilir. PSA testinin kullanımını optimize etmek ve kanser teşhislerinin doğruluğunu artırmak için daha fazla araştırma yapılması gerekmektedir.

ANAHTAR KELİMELER: Prostat spesifik antijen, Prostat kanseri, Tarama, Tanı.

ABSTRACT

OBJECTIVE: This study aims to evaluate the utilization and outcomes of PSA (Prostate-Specific Antigen) testing in the context of prostate cancer screening and diagnosis. The patterns of the PSA testing, the rates of exceeding the reference range, and its relationship with cancer diagnoses were examined in the study.

MATERIAL AND METHODS: Data for a five-year period (2017 - 2021) were analyzed, including a total of 148,526,228 PSA tests requested from 27,146,267 individuals. The test counts, test rates per population, and rates of exceeding the reference range were assessed based on gender, age groups, geographic regions, and healthcare institution types. The rates of cancer diagnosis among individuals who underwent PSA testing were also examined.

RESULTS: The study reveals that PSA testing was not only performed on men, but also on a significant number of women. The test counts and rates per population varied across different age groups, with higher rates observed in older individuals. The rates of exceeding the reference range were highest among older age groups. The cancer diagnosis rates among individuals who underwent PSA testing were found to be moderate but varied across different years. The study also highlights the differences in test utilization and outcomes based on geographic regions and healthcare institution types.

CONCLUSIONS: PSA testing is widely utilized for prostate cancer screening and diagnosis. The findings of this study emphasize the need for a comprehensive evaluation of PSA testing patterns, outcomes, and limitations. The results contribute to a better understanding of the appropriateness and effectiveness of PSA testing in different populations. Further research is required to optimize the use of PSA testing and improve the accuracy of cancer diagnoses.

KEYWORDS: Prostate-specific antigen, Prostate cancer, Screening, Diagnosis.

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INTRODUCTION

Prostate cancer is a significant health concern globally. The early and accurate detection of this disease plays a crucial role in reducing its associated morbidity and mortality rates. Prostate-Specific Antigen (PSA), a glycoprotein biomarker secreted by both normal and neoplastic prostate tissues, serves as an essential tool in this regard. Despite its widespread use in prostate cancer screening, the application of PSA remains a subject of debate due to the various factors that can influence its levels, including benign prostatic hyperplasia, prostate cancer, prostatitis, perineal trauma, and the use of certain medications such as 5-alpha reductase inhibitors, nonsteroidal anti-inflammatory drugs, acetaminophen, statins, and thiazide diuretics (1).

Cancer remains one of the most significant health threats globally. Early diagnosis and effective treatment play key roles in reducing cancer mortality, highlighting the potential importance of tumor markers. These biochemical indicators, used in diagnosing cancer, prognosticating, and monitoring treatment response, come with their own costs that require efficient management.

The costs associated with cancer have been steadily increasing over the past decade, thought to be linked with advancements in cancer treatments and widespread usage of screening tests.

The European Association of Urology (EAU) has proposed an algorithm based on the results of a European randomized prostate cancer study, suggesting that a personalized strategy could reduce the harmful effects of screening and potentially decrease the incidence of metastases and death rates. This algorithm involves the determination of basal PSA levels in well-defined subjects and proposes specific follow-ups based on these levels. Recent recommendations from the European Commission have also emphasized the combined use of magnetic resonance imaging (MRI) and PSA for follow-up in individuals up to the age of 70 (2).

In light of these findings, the current study aims to evaluate the utility and effectiveness of the PSA test within the context of the EAU's recommended algorithm and the recent

suggestions of the European Commission. Specifically, we will utilize data provided by the Ministry of Health to explore the influence of various factors on PSA levels, as well as the potential benefits and risks of PSA testing. Additionally, we will investigate the cost-effectiveness of incorporating MRI into routine PSA screening and monitoring procedures.

Our ultimate objective is to provide a comprehensive understanding of the role and utility of PSA in the diagnosis and management of prostate cancer. This study is expected to contribute to more informed decisions in clinical practice and policy-making in prostate cancer care.

MATERIALS AND METHODS

Data for the five-year period (2017 - 2021) were analyzed, including a total of 148,526,228 PSA tests requested from 27,146,267 individuals. The test counts, rates of testing per population, and rates of exceeding the reference range were assessed based on gender, age groups, geographic regions, and healthcare institution types.

The PSA test results were obtained from the e-Nabız (e-Pulse) system of the Republic of Turkey Ministry of Health. In Turkey, the database service is referred to as e-Nabız. The transmission of health data set packages is facilitated through Extensible Markup Language (XML) web services. This database encompasses the health records of patients who have sought medical services from all healthcare institutions in Turkey, including their demographic characteristics, laboratory data, medication usage, comorbidities, and other health-related records. The PSA levels represent results obtained through the immunoassay method.

Database and e-Pulse

e-Pulse is a platform developed by the Ministry of Health in Turkey, that allows individuals to store and manage their health information digitally. For this study, patient information and health records were collected from the e-Pulse system. During the data collection process, personal information was protected and the principle of privacy was fully respected.

Health Coding Reference Server (SKRS) and International Statistical Classification of Diseases and Related Health Problems (ICD) Codes

SKRS is a data recording and reporting system used by the Ministry of Health in Turkey. This system helps to manage health services more effectively. In this study, data pulled from the SKRS and ICD codes were used to analyze disease diagnoses, treatment plans, and the overall state of health services.

ICD codes are a standard disease and health problem classification system created by the World Health Organization and used worldwide. These codes are an important tool for identifying, monitoring, and treating diseases.

Study Design

This retrospective study utilized data from the Ministry of Health, covering a five-year period from 2017 to 2021. The data included information on PSA (Prostate-Specific Antigen) tests requested from individuals across different regions and healthcare institutions in the country.

Data Collection

The data were collected from medical records and laboratory databases. The information included demographics (gender, age), test requests, test results, cancer diagnoses, and healthcare institution types.

Study Population

The study population consisted of individuals who underwent PSA testing during the study period. Both men and women were included in the analysis.

Ethical Committee

The study adhered to ethical guidelines and protected the privacy and confidentiality of the individuals included in the data. Institutional review board approval was obtained, and all data were anonymized to ensure privacy.

Statistical Analysis

Descriptive statistics were used to analyze the data. The test counts, test rates per population, rates of exceeding the reference range, and cancer diagnosis rates were calculated and compared across different vari-

ables, including gender, age groups, geographic regions, and healthcare institution types.

RESULTS

In the period between 2017 and 2021, PSA-total tests were requested from a total of 5,812,043 individuals, resulting in a test count of 21,547,232. The average number of tests per person was calculated as 3.71, and the test rate per 100,000 population was 26,074. PSA-total test had the highest number of requests per individual and ranked as the 5th most requested tumor marker per 100,000 population. This article presents the findings of PSA-Free tests conducted in Turkey between 2017 and 2021. A total of 12,876,151 tests were analyzed from 3,020,756 individuals, resulting in an average of 4.26 tests per person. The test rate per 100,000 population was calculated as 15,581. Among all tumor markers used in the PSA-Free study, this test had the third lowest test rate per 100,000 population (**Table 1**).

Table 1: Number of tests and the ratio of the population by years

	2017		2018		2019		2020		2021	
	Number of tests	Number of Tests Per 100,000 Population	Number of tests	Number of Tests Per 100,000 Population	Number of tests	Number of Tests Per 100,000 Population	Number of tests	Number of Tests Per 100,000 Population	Number of tests	Number of Tests Per 100,000 Population
PSA FREE	2,493,603	3,086	2,831,762	3,453	3,089,842	3,716	2,129,377	2,547	2,331,567	2,788
PSA TOTAL	3,965,828	4,908	4,639,514	5,658	5,270,443	6,338	3,642,385	4,356	4,029,062	4,819

When comparing the PSA-total test counts across years, it is observed that there was an increasing trend in both test count and the test rate per 100,000 population from 2017 to 2019. However, a significant decrease was observed in 2020 and 2021.

Among all tumor markers requested in females, PSA-total test had the third lowest number of requests. In males, the test request count followed a similar pattern to the general population, with an increasing trend from 2017 to 2019 and a noticeable decrease in 2020 and 2021. The test request count and the test rate per 100,000 population were highest for males. When comparing the ratio of female-to-male test counts across years, the ratios were 1/233 in 2017, 1/199 in 2018, 1/96 in 2019, 1/119 in 2020, and 1/77 in 2021. Except for NSE and PSA, other tumor markers were more frequ-

ently requested in female patients throughout the years. Analyzing the test requests by age groups, PSA-total test was most commonly requested in the 18-64 age group, followed by the 65 and above age group. The lowest test request count was observed in the 0-17 age group. When comparing the test request counts between the 18-64 age group and the 65 and above age group, the ratios for 2017 to 2021 were 1.40, 1.42, 1.41, 1.45, and 1.38, respectively. When analyzed by age groups, the PSA-Free test was found to be most requested in the 18-64 age range, followed by the 65 and older age group. The lowest demand was observed in the 0-17 age group. When comparing the demand ratio between the 18-64 and 65 and older age groups, the ratios for 2017 - 2021 were 1.39, 1.40, 1.37, 1.42, and 1.35, respectively. Regarding the tests per 100,000 population, the lowest ratio was in the 0-17 age group, followed by the 18-64 age group, and the highest ratio was in the 65 and older age group. In terms of test consumption per 100,000 population, the ratios for 2017 to 2021 were 1/5.27, 1/5.07, 1/4.92, 1/4.55, and 1/4.81, respectively. When comparing the test consumption rates by age groups per 100,000 population, the lowest rate was observed in the 0-17 age group, followed by the 18-64 age group, and the highest rate was in the 65 and above age group (**Table 2**).

Table 2: Test consumption per 100,000 persons by years and age groups

	2017			2018			2019			2020			2021		
	0-17	18-64	65+	0-17	18-64	65+	0-17	18-64	65+	0-17	18-64	65+	0-17	18-64	65+
PSA FREE	12	2,840	15,104	14	3,188	16,336	24	3,390	17,179	17	2,362	11,011	27	2,527	12,428
PSA TOTAL	19	4,533	23,905	26	5,245	26,601	49	5,850	28,801	29	4,077	18,587	41	4,407	21,221

When examining the cancer diagnosis rates among individuals who underwent PSA-total testing, the rates were 17% in 2017 - 2018, 16% in 2019, 18% in 2020, and 15% in 2021. PSA-free and PSA-total tests had the lowest rates of cancer diagnosis among individuals tested for tumor markers. Among patients who underwent PSA-Free testing, the rates of receiving a cancer diagnosis at any time were found to be 17% for 2017 - 2019, 18% for 2020, and 15% for 2021.

PSA-Free and PSA-Total tests had the lowest diagnosis rates among patients. Analyzing the timing of test requests in relation to cancer diagnosis, it was observed that except for 2017, the majority of tests were requested before the diagnosis. In 2017, the highest proportion of tests were requested at the time of diagnosis. When comparing the test request rates based on timing (before diagnosis/at the time of diagnosis/after diagnosis), the ratios for 2017 to 2021 were 1.26/1.50/1, 3.34/1.79/1, 4.60/1.55/1, 5.16/1.04/1, and 5.58/0.57/1, respectively (**Table 3**).

Table 3: Percentage distribution of who required tumor markers were diagnosed with cancer at any time

	2017			2018			2019			2020			2021		
	NO DIAGNOSIS OF CANCER	DIAGNOSIS OF CANCER	DIAGNOSIS OF CANCER AT THE TIME OF DIAGNOSIS	NO DIAGNOSIS OF CANCER	DIAGNOSIS OF CANCER	DIAGNOSIS OF CANCER AT THE TIME OF DIAGNOSIS	NO DIAGNOSIS OF CANCER	DIAGNOSIS OF CANCER	DIAGNOSIS OF CANCER AT THE TIME OF DIAGNOSIS	NO DIAGNOSIS OF CANCER	DIAGNOSIS OF CANCER	DIAGNOSIS OF CANCER AT THE TIME OF DIAGNOSIS	NO DIAGNOSIS OF CANCER	DIAGNOSIS OF CANCER	DIAGNOSIS OF CANCER AT THE TIME OF DIAGNOSIS
PSA Free	2,080,422	83.43%	413,181	2,356,691	83.22%	475,071	1,678,826	83.46%	511,016	1,749,414	82.16%	379,961	1,784,023	85.09%	347,544
PSA Total	3,301,594	83.26%	663,824	3,663,133	83.27%	776,381	4,414,383	83.76%	856,060	2,994,236	82.21%	648,149	3,431,773	85.18%	597,289

In 2017, 2.90% of individuals who underwent PSA testing received a PSA-related cancer diagnosis, while 6.36% received a non-PSA-related cancer diagnosis. In 2021, these rates were 3.16% and 7.34%, respectively. When comparing the ratios of individuals diagnosed with PSA-related cancer to those diagnosed with non-PSA-related cancer, the ratios for 2017 to 2021 were 1/2.19, 1/2.20, 1/2.23, and 1/2.32, respectively (**Table 4**).

Table 4: Distribution of cancer diagnosis related to PSA

YEAR	RELATED CANCER DIAGNOSIS	NON-RELATED CANCER DIAGNOSIS	TOTAL NUMBER OF PEOPLE TESTED
2017	52,413	2.90%	115,014
2018	62,694	2.98%	138,377
2019	69,165	2.92%	152,645
2020	62,072	3.58%	139,086
2021	61,886	3.16%	143,671

PSA testing was most commonly requested in the Marmara region, followed by the Central Anatolia region, while the lowest test request count was observed in the Southeastern Anatolia region. When comparing the test rates per 100,000 population between the Marmara region (ranking 1st) and the Southeastern Anatolia region (ranking last), the ratio was 7.7. When analyzing the test request counts per 100,000 population by geographic regions, except for 2017 (where the Aegean region ranked 1st), the Central Anatolia region had the highest request count (2017 - 2018). The Southeastern Anatolia region consistently had the lowest

request count. When comparing the region with the highest test rate (Central Anatolia) to the region with the lowest test rate (Southeastern Anatolia) in 2021, the ratio was 1.16, indicating a significant difference (**Table 5**).

Table 5: PSA total geographical distribution by years and test per population of 100,000 persons

2017	2018		2019		2020		2021		
AEGEAN REGION	6.344	CENTRAL ANATOLIA REGION	7.283	CENTRAL ANATOLIA REGION	9.135	CENTRAL ANATOLIA REGION	6.063	CENTRAL ANATOLIA REGION	6.825
CENTRAL ANATOLIA REGION	6.005	AEGEAN REGION	7.079	AEGEAN REGION	7.627	AEGEAN REGION	5.174	AEGEAN REGION	5.848
BLACK SEA REGION	5.823	BLACK SEA REGION	6.486	BLACK SEA REGION	6.965	BLACK SEA REGION	5.141	BLACK SEA REGION	5.804
MARMARA REGION	4.915	MARMARA BÖLGEİ	5.661	MARMARA REGION	6.142	MARMARA REGION	4.254	MEDITERRANEAN REGION	4.682
MEDITERRANEAN REGION	4.529	MEDITERRANEAN REGION	5.376	MEDITERRANEAN REGION	5.949	MEDITERRANEAN REGION	4.241	MARMARA REGION	4.555
EASTERN ANATOLIA REGION	3.844	EASTERN ANATOLIA REGION	4.151	EASTERN ANATOLIA REGION	4.424	EASTERN ANATOLIA REGION	2.886	EASTERN ANATOLIA REGION	3.248
SOUTHEAST ANATOLIA REGION	1.893	SOUTHEAST ANATOLIA REGION	2.160	SOUTHEAST ANATOLIA REGION	2.373	SOUTHEAST ANATOLIA REGION	1.516	SOUTHEAST ANATOLIA REGION	1.669

Examining the test request counts by clinics, it was found that throughout all years, urology clinics had the highest number of test requests. Internal Medicine clinics ranked second in 2017 - 2018, while Family Medicine clinics ranked second in 2019 - 2021. Medical Oncology clinics consistently ranked fourth. Public Health clinics ranked fifth in 2019 - 2021. Emergency Medicine clinics ranked 10th in 2017 - 2018, 8th in 2019 - 2020, and 10th in 2021 (**Table 6**).

Table 6: PSA Top 10 Clinics by Years and Number of Test Requests

2017	2018		2019		2020		2021		
Urology	1,970,793	Urology	2,221,897	Urology	2,342,237	Urology	1,471,240	Urology	1,501,446
Internal Medicine	633,117	Internal Medicine	713,180	Family Medicine	920,340	Family Medicine	684,886	Family Medicine	917,517
Family Medicine	489,928	Family Medicine	678,811	Internal Medicine	726,862	Internal Medicine	509,526	Internal Medicine	581,256
Medical Oncology	130,522	Medical Oncology	162,684	Medical Oncology	192,769	Medical Oncology	191,521	Medical Oncology	184,913
General Surgery	121,952	General Surgery	135,157	Public Health	134,155	Public Health	111,763	Public Health	119,955
Radiation Oncology	64,540	Radiation Oncology	80,508	General Surgery	131,942	General Surgery	89,759	General Surgery	96,721
Cardiology	62,597	Gastroenterology	73,377	Radiation Oncology	92,328	Radiation Oncology	63,265	Gastroenterology	65,338
Gastroenterology	58,927	Cardiology	72,780	Emergency Medicine	80,583	Emergency Medicine	59,723	Radiation Oncology	57,510
Nephrology	58,093	Nephrology	66,448	Gastroenterology	78,130	Gastroenterology	55,999	Cardiology	56,905
Emergency Medicine	47,620	Emergency Medicine	55,884	Cardiology	75,311	Cardiology	54,730	Emergency Medicine	56,703

The most frequent diagnosis entered in the PSA-total test requests was benign prostatic hyperplasia, followed by urinary system infection (unspecified) and essential (primary) hypertension. These rankings remained consistent over the five-year period.

When comparing the rates of exceeding the reference range for the PSA-total test across years, the highest rate was 17.59% in 2017, while

the lowest rate was 16.28% in 2021. Among all tumor markers, the PSA-total test had the highest rate of exceeding the reference range in 2019 - 2021. Analyzing the rates of exceeding the reference range by level of care, tertiary care institutions had the highest rate at 19.41%, followed by secondary care institutions at 17.66%, and primary care institutions had the lowest rate at 8.90%. When examining the rates of exceeding the reference range by institution types, the overall rate was 16.81%, with university hospitals having the highest rate at 23.53%, private healthcare institutions at 18.56%, and public hospitals at 16.16% (**Table 7**).

Table 7: Rate of Testing Over the Reference Range by Years

	2017	2018	2019	2020	2021
PSA TOTAL	17.59%	17.54%	16.31%	16.78%	16.28%
PSA FREE	17.39%	17.07%	16.96%	17.67%	17.32%

Rate of Testing Over the Reference Range According to Institution Step Types

	First Step	Second Stage	Third Step	Total
PSA TOTAL	8.90%	17.66%	19.41%	16.81%
PSA FREE	9.34%	19.24%	19.38%	17.25%

Exceed Rate of Tests Over the Reference Range According to Institution Types

	Public Hospitals	Private Health Institution	University Hospital	Total
PSA TOTAL	16.16%	18.56%	23.53%	16.81%
PSA FREE	16.38%	19.19%	20.08%	17.25%

Examining the rates of exceeding the reference range by age groups, the highest rate of 24.94% was observed in the 65 and above age group, followed by 10.80% in the 18-64 age group, and 0.25% in the 0-17 age group. When comparing the age groups, the ratios were calculated as 1/43.2/99.76, respectively. Analyzing the rates of exceeding the reference range by admission status, the highest rate of 23.12% was observed in inpatients, followed by 19.58% in outpatients, and 16.53% in day patients. When comparing the rates between these groups, the ratios were 1.39/1.18/1, respectively. Among day patients, the PSA-total test had the highest rate of exceeding the reference range. In terms of cancer diagnoses among individuals who underwent PSA-total testing, the overall rate of positive findings was 16.81%, with 28.31% of patients having a cancer diagnosis and 14.90% having no cancer diagnosis. Among individuals with a cancer diagnosis, the PSA-total test ranked second.

When examining the distribution of test costs across years, the cost per test unit was 25,777,882 TL in 2017, and 26,188,903 TL in 2021. The unit cost per test was 15,537,562 TL in 2017 and 15,785,304 TL in 2021.

DISCUSSION

PSA (Prostate-Specific Antigen) testing has been widely used for prostate cancer screening, although its utility remains controversial. Prostate cancer is the second most common cancer in men and accounts for 3.8% of cancer-related deaths (3). However, our study indicates that PSA testing was also performed on a significant number of women, with 32,784 women undergoing PSA-free tests and 51,451 women undergoing PSA-total tests in 2021. When comparing the test counts between genders, the ratios per year were 1/192 in 2017, 1/164 in 2018, 1/174 in 2019, 1/100 in 2020, and 1/70 in 2021. It is noteworthy that tumor markers other than NSE and PSA were requested more frequently in women. When examining the rates of exceeding the reference range by gender, the overall rate was 17.26%, with 17.33% in males and 0.93% in females.

The incidence of prostate cancer is approximately 0.3% in individuals under the age of 50 and around 60% in those aged 65 and above (4). Autopsy series have revealed prostate cancer in 30% of men in the 60-69 age group and 67% in the 80-89 age group (5).

In our study, when comparing the test request counts by age groups over the years, PSA-free tests were most commonly requested in the 18-64 age group, followed by the 65 and above age group, and least frequently in the 0-17 age group. When comparing the test consumption per 100,000 population by age groups, the lowest rate was observed in the 0-17 age group, followed by the 18-64 age group, and the highest rate was found in the 65 and above age group. This pattern is consistent with tumor markers other than NSE. When examining the rates of exceeding the reference range by age groups, the highest rate of 27.27% was observed in the 65 and above age group, followed by 9.88% in the 18-64 age group, and 0.96% in the 0-17 age group.

The measurement of serum PSA levels has led to an increase in prostate cancer incidence and has been beneficial in the detection of early-stage diseases. However, when long-term outcomes were examined, it was found that PSA testing did not have an impact on overall survival. For individuals up to the age of 70, com-

paring magnetic resonance imaging with PSA as a follow-up test is considered appropriate (6).

When analyzing the timing of test requests in relation to diagnosis, it is notable that in all years except for 2017, tests were more frequently requested before the diagnosis, while in 2017, they were predominantly requested at the time of diagnosis.

The sensitivity of PSA varies between 9% and 33% depending on age and the PSA threshold used. It has been shown that up to 91% of individuals with high PSA values do not have prostate cancer. The risk of developing prostate cancer in men with high PSA values is determined to be around 30% (7).

When a PSA threshold of 4 ng/dL is used, the specificity is calculated as 91% (8). In our study, when comparing the rates of receiving a cancer diagnosis at any time among individuals who had PSA-free tests, the rates were 17% in 2017-2019, 18% in 2020, and 15% in 2021. When comparing the rates of cancer detection among individuals who had tumor marker tests requested, the lowest rates were observed for PSA-free and PSA-total tests.

In 2017, 2.90% of individuals who had PSA tests received a diagnosis of PSA-related cancer, while 6.36% received a diagnosis of non-PSA-related cancer. In 2021, these rates were 3.16% and 7.34%, respectively.

When comparing the rates of exceeding the reference range over the years, the highest rate was observed in 2020 at 17.67%, while the lowest rate was in 2019 at 16.96%. Among tumor markers, the second highest rate of exceeding the reference range was observed for PSA tests between 2019 and 2021.

When comparing the rates of exceeding the reference range by institution type, the highest rate was observed in tertiary care institutions, followed by secondary care institutions, and primary care institutions.

When examining the rates of exceeding the reference range by institution types, the overall rate was 17.25%, with the highest rates in university hospitals, followed by private healthcare institutions, and public hospitals. When comparing the rates of exceeding the reference range

by cancer diagnosis status, the overall rate was 17.25%, with 25.9% of patients having a cancer diagnosis and 15.71% having no cancer diagnosis. Among individuals with a cancer diagnosis, the tested tumor markers ranked third.

There may be some data gaps or missing records in our study. These omissions can limit the completeness of the results and the overall picture presented. The records and documentation methods during the data collection period may be prone to errors or biases. This can impact the accuracy of the results. Given the focus on a specific test or marker in our study, there may be limitations in evaluating other potential factors or markers. This can restrict the applicability of the findings to overall prostate cancer screening or diagnosis. Employs a retrospective design, analyzing data retrospectively. As a result, our ability to establish forward-looking causal relationships or control for variables is limited. The methods and measurements used in this study may vary across different healthcare institutions or settings. This can affect the comparability of the results and the ability to generalize findings.

Despite these limitations, we believe that our study makes a significant contribution to evaluating the utilization and outcomes of PSA testing during a specific period. However, further comprehensive and prospective research is needed to enhance understanding in this area. In conclusion, our study sheds light on the utilization and outcomes of PSA testing, not only in men but also in women. The findings indicate that PSA testing was performed on a considerable number of women, raising questions about its appropriateness for this population. There were variations in test request patterns based on gender and age groups, with higher rates of exceeding the reference range observed in older age groups. While PSA testing has contributed to the detection of prostate cancer and the identification of early-stage diseases, its long-term impact on survival remains uncertain. Further research is needed to better understand the appropriate use and limitations of PSA testing, particularly in diverse populations.

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