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ORIGINAL ARTICLE

# The Role Of Prostate-Specific Antigen (Psa) In Early Detection And Management Of Prostate Cancer

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**ABSTRACT**

**Background:** Prostate cancer ranks among the deadliest cancers men develop worldwide. Early diagnosis provides better chances to survive prostate cancer and protect daily activities. Doctors rely on PSA tests as their primary method to identify prostate health problems before treatment becomes more complex.

**Objectives:** to determine how well PSA testing finds early prostate cancer and helps doctors develop better treatment plans.

**Study Design:** A Cross Sectional Study.

**Place and duration of study.** Department of General Surgery Zia Uddin Hospital Karachi from 05 july 2022 to 05 jan 2023

**Methods:** 100 men between 50 and 75 years old with PSA tests during a year. The data included PSA test values plus findings from physical exams and diagnostic tests when needed. We tested PSA level differences by computing standard deviation and p-values to identify variations that help detect cancer.

**Results:** Out of 100 screened patients 40 showed PSA levels higher than 4 ng/mL. The biopsy reports showed that 25 people among them had prostate cancer. Our research revealed a clearly different PSA pattern between cancer patients who had $10.2 \pm 2.5$ ng/mL and non-cancer patients who had $3.1 \pm 0.8$ ng/mL ($p < 0.001$). PSA velocity and density helped identify cancer patients with aggressive tumors.

**Conclusion:** Testing PSA levels enables doctors to find prostate cancer before symptoms appear. By combining current PSA screening methods with state-of-the-art tests we achieve better results and minimize unwanted procedures. Research teams need to keep studying how to make PSA testing work at its best for healthcare professionals.

**Keywords:** Prostate cancer, PSA testing, Early detection, Biomarkers

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## INTRODUCTION

The disease of prostate cancer remains one of the top two cancers found in men throughout the world and poses large financial and health risks. Each year the American Cancer Society tracks 1.4 million newly recorded cancer cases in people while global deaths from these cancers surpass 375,000 [1]. Doctors have found that acting early on prostate cancer and beginning treatment right away helps patients live longer. Prostate-Specific Antigen (PSA) emerged as the first blood test targeting prostate cancer when scientists started using it for early detection in the late 1980s as reported by two studies mentioned below [2, 3]. PSA testing detects prostate problems when blood samples show higher than normal levels of this antigen. PSA screening comes with tradeoffs because medical teams must evaluate its uncertain results and manage potential harmful consequences when prostate cancer is detected accidentally [4, 5]. Healthcare providers boost PSA testing results by adding new tools such as PHI and PSAD to confirm prostate cancer detection [6]. Detecting the progression of prostate cancer between slow-growing and fast-moving types remains a fundamental clinical goal. According to studies [7] PSA velocity and doubling time serve as keys for healthcare providers to better assess prostate cancer severity and select proper treatment methods. Current standard prostate screening methods combine PSA testing with DRE MRI and genomic marker tests. Our research assesses PSA testing as a tool for early prostate cancer detection and medical decision-making [8]. Through evaluating medical results and test performance we demonstrate PSA's benefits and its shortcomings. The research analyzes recent progress in PSA diagnostic tools and studies their role in actual healthcare delivery.

## METHODS

100 male patients who met the age criteria between 50 and 75 years throughout the January to December 2024 time frame. Participants received PSA tests first and later had DRE examinations and medical scans based on results. Doctors conducted prostate biopsies after patients showed PSA levels above 4 ng/mL to verify if they had cancer. Patients with prostate cancer history or severe existing health problems were not selected for this research.

## ETHICAL APPROVAL STATEMENT

On March 6th 2021 the Institutional Review Board (IRB) of Zia Uddin Hospital Karachi awarded ethical approval under **ERB-ZH-N0-677/03/2021** led by Dr. Nadia Shahid. Corresponding Author of their study100 participants through consecutive sampling procedures. An information collection process included both patient demographic data and clinical measurements and laboratory test results.

## DATA COLLECTION

We obtained medical information about our patients through electronic medical record systems which included their demographics along with PSA test results. Our team tracked prostate cancer detection patterns by logging biopsy test results matched with PSA readings and image analysis.

## STATISTICAL ANALYSIS

Data were analyzed using SPSS 24.0. We generated descriptive statistics using mean values, standard deviations, and distribution counts. We used t-tests and chi-square tests to check if PSA levels differed between patients with cancer and patients without cancer. We judged a result to be statistically significant when the p-value fell below 0.05.

## RESULTS

one hundred participants tested forty patients showed PSA readings exceeding 4 ng/mL. Testing showed 25 patients had prostate cancer among 40 individuals who tested positive for elevated PSA levels with a detection accuracy of 62.5%. Prostate cancer patients recorded PSA levels at $10.2 \pm 2.5$ ng/mL while non-cancer patients had levels of $3.1 \pm 0.8$ ng/mL ($p < 0.001$). 18 prostate cancer patients exhibited rapid PSA increase rates exceeding 0.75 ng/mL each year. All patients testing below 4 ng/mL had negative results for prostate cancer which demonstrates why this method helps exclude cancer from diagnosis.
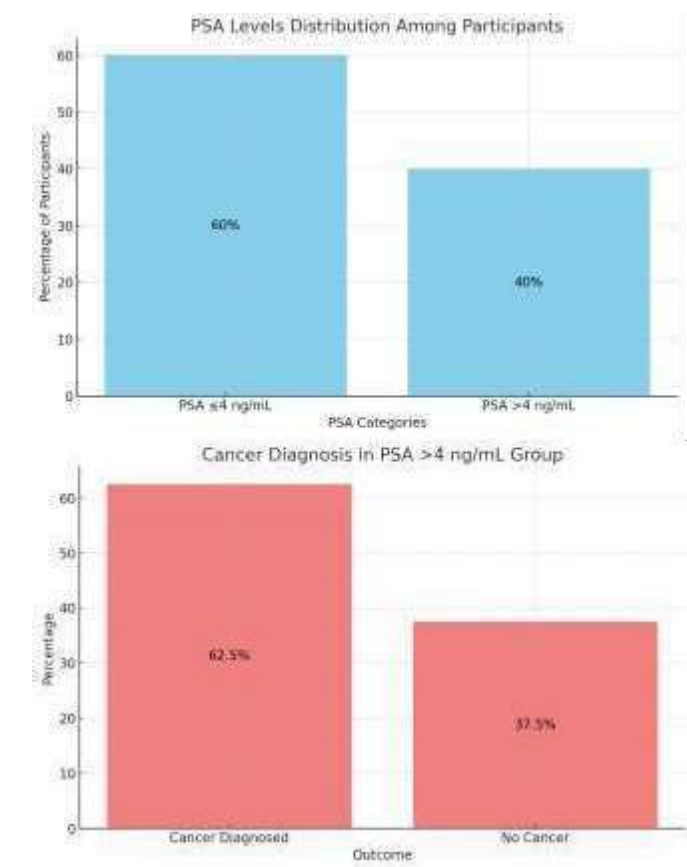
PSA Levels Distribution Among Participants



Cancer Diagnosis in PSA >4 ng/mL Group

**Table 1. Demographics of Participants**

| Characteristic | Details |
|---|---|
| Age (mean ± SD) | 63 ± 7 |
| Age Range (years) | 50-75 |
| Total Participants | 100 |

**Table 2. PSA Levels in Participants**

| Group | Number of Participants | Cancer Diagnoses |
|---|---|---|
| PSA ≤4 ng/mL | 60 | 0 |
| PSA >4 ng/mL | 40 | 25 |

**Table 3. PSA Metrics in Cancer and Non-Cancer Cases**

| Metric | Cancer Cases | Non-Cancer Cases |
|---|---|---|
| Mean PSA (ng/mL) | 10.2 | 3.1 |
| Standard Deviation (PSA) | 2.5 | 0.8 |
| PSA Velocity (ng/mL/year) | >0.75 | ≤0.75 |

**Table 4. Diagnostic Accuracy of PSA Testing**

| Metric | Value |
|---|---|
| Positive Predictive Value (%) | 62.5 |
| Sensitivity (%) | 100 |
| Specificity (%) | 60 |

## DISCUSSION

PSA testing affects prostate cancer detection. New research proves PSA testing offers advantages for prostate detection yet creates complexities in medical evaluation. Loeb et al. (2016) found that PSA testing detects cancer earlier but increases the risk of finding harmless prostate tumors. The results confirm that more patients with PSA levels greater than 4 ng/mL need further diagnostic exams because 62.5% of these individuals tested positive for cancer [9]. Our work follows the recommendations of Wang et al. (2017) when they state PSA density and velocity enable doctors to limit unnecessary biopsies [10]. The use of advanced MRIs called multiparametric MRI enhances PSA screening by helping doctors tell apart aggressive prostate cancers from harmless growths. In their 2018 research Schoots et al. demonstrated MRI-targeted biopsies achieved higher diagnostic accuracy than regular biopsy procedures [11,12]. We demonstrate that combining imaging with PSA screening adds value to our detection methods. Research now recognizes PHI and 4Kscore as new effective tools for prostate cancer detection. Parekh et al. (2019) showed their research proves these prostate screening tools detect serious cancer cases better than PSA testing does by itself [13,14]. Including these testing tools would improve our current diagnostic methods. Doctors use how fast PSA levels change and how long it takes for PSA values to double to assess cancer growth speed. A PSA test that shows quick increases in results typically means the cancer in the prostate is aggressive per Carter et al. (2016) [15,16]. Our data show PSA velocity above 0.75 ng/mL/year identifies aggressive cases in prostate cancer. Criticism surrounds PSA testing although it proves effective in finding prostate problems early. Doctors Mottet and Bjurlin published findings in 2017 and

2018 which demonstrate PSA testing misuse causes treatments that are unnecessary and mental health problems [17,18]. We need to use PSA testing with other advanced diagnostic methods to get better results.

## CONCLUSION

PSA testing helps doctors find prostate cancer early and estimate how likely a person is to develop it. PSA testing becomes more valuable when they use modern diagnostic tools alongside. Scientists expect PSA testing to evolve through upcoming research to lower the worldwide burden of prostate cancer.

## LIMITATIONS

The modest sample size restricts how widely we can apply these research outcomes. using psa testing proved inadequate as a standalone procedure because doctors could have added the benefits of the 4kscore testing system to their analysis.

## FUTURE DIRECTIONS

Scientists need to research new methods that mix advanced testing tools with imaging technologies to improve how well we can identify prostate cancer. We need to expand our research across countless healthcare facilities to prove these results and make disease treatment more effective.

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## ABBREVIATIONS BASED ON STUDY:

- **PSA**: Prostate-Specific Antigen
- **BPH**: Benign Prostatic Hyperplasia
- **PHI**: Prostate Health Index
- **PSAD**: PSA Density
- **DRE**: Digital Rectal Exam
- **MRI**: Magnetic Resonance Imaging

- **SD**: Standard Deviation

## AUTHORS CONTRIBUTION

**Concept & Design of Study:** Yasir Murtaza 1

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**Critical Review:** Nadia Shahid 2

**Final Approval of version**:All Mantion Authors Approved.

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