KESANS: International Journal of Health and Science
2808-7178 / 2808-7380
http://kesans.rifainstitute.com/index.php/kesans/index

Analysis of Prostate-Specific Antigen Examination Results Using the iChroma II Device at Pandan Arang Hospital Boyolali During July–September 2025

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Article Information
Submitted: **06 July 2026**
Accepted: **04 August 2026**
Publish: **08 August 2026**

Keyword: iChroma II; Prostate-Specific Antigen; Prostate Cancer; Tumor Marker;

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Year: 2026

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Abstract
Introduction: *Prostate-specific antigen is an important biomarker used in the early detection and monitoring of prostate disorders.* ***Objective:*** *This study aimed to identify the distribution of prostate-specific antigen examination results by age group, determine the proportion of normal and abnormal prostate-specific antigen levels, and analyze the relationship between age and prostate-specific antigen levels in male patients at RSUD Pandan Arang Boyolali.* ***Method:*** *This descriptive study was conducted at the laboratory of RSUD Pandan Arang Boyolali from July to September 2025 using purposive sampling. A total of 33 male patients aged more than 50 years with complete medical records were included. Prostate-specific antigen levels were measured using the iChroma II device.* ***Result and Discussion:*** *Most patients had prostate-specific antigen levels within the normal range (60.6%), while 18.1% had low levels and 21.2% had high levels. Patients with elevated prostate-specific antigen levels were 52 to 83 years old, and the highest values were found in older patients. These findings indicate an age-related tendency toward increased prostate-specific antigen levels.* ***Conclusions:*** *There was a relationship between increasing age and prostate-specific antigen levels among male patients examined using iChroma II at RSUD Pandan Arang Boyolali.*

How to Cite **Monika Putri Solikah, Mayasyah Adelia Putri, Puput Handayani, Inapoik Feroni Kelyau Tanody, Fikran Suneth/Analysis of Prostate-Specific Antigen Examination Results Using the iChroma II Device at Pandan Arang Hospital Boyolali During July–September 2025/Vol. 5, No. 10, 2026**
DOI https://doi.org/10.54543/kesans.v5i10.688
e-ISSN/p-ISSN **2808-7178 / 2808-7380**
Published by **CV. Rifainstitut/KESANS: International Journal of Health and Science**

Introduction

The prostate is an accessory gland of the male reproductive system that contributes to seminal fluid production and secretes prostate-specific antigen, a protein that is normally present at low concentrations in the blood of healthy men (Harianja & Sari, 2022); (Karimah et al., 2025); (Tira et al., 2026). Prostate-specific antigen examination is widely used to support the detection and monitoring of prostate disorders, including benign prostatic hyperplasia, prostatitis, and prostate cancer (Pamungkas, 2021); (Sugiharto, Santoso, Raharjo, Hardjanto, & Firmansyah, 2025)

Prostate disorders remain a relevant public health issue. The article in the Sehati template states that World Health Organization data for 2020 reported prostate cancer as the second most common cancer in men globally, with 1.414 million new cases and 375 thousand deaths, while Indonesia recorded 13,563 new cases and 4,863 deaths in the same year (World Health Organization, 2020). The same source also notes that benign prostatic hyperplasia increased from 5.48 million cases in 1990 to 11.26 million cases in 2019, indicating a growing burden of prostate-related disease (Xu et al., 2021); (Safriadi et al., 2022); (Deby, Kertadjaya, & Mappadang, 2022)

The Sehati manuscript also explains that patient visits related to urinary tract complaints in Boyolali increased by 12% over the previous two years, suggesting that prostate-related conditions deserve greater clinical attention in older men. In this context, PSA testing is valuable because it offers a non-invasive approach for early detection and can be performed using point-of-care technology such as iChroma II, which applies a fluorescence immunoassay principle for quantitative PSA measurement (Beltran et al., 2018).

In this study, PSA results were classified against a reference interval of 0.27–3.42 ng/mL, corresponding to the general, non-age-stratified reference range applied for routine PSA screening at the study site. It is important to note, however, that this single reference interval represents a simplification of PSA physiology. Serum PSA concentration is known to rise progressively with age as a consequence of normal prostatic growth, which led Oesterling et al. (1993) to establish age-specific reference ranges of approximately 0–2.5 ng/mL for men aged 40–49 years, 0–3.5 ng/mL for 50–59 years, 0–4.5 ng/mL for 60–69 years, and 0–6.5 ng/mL for men aged 70 years and above (Purhadi, Indrayanti, Cahyono, & Setiadi, 2025). Beyond age, PSA levels can also be transiently elevated by non-malignant clinical conditions such as benign prostatic hyperplasia, prostatitis, urinary retention, recent ejaculation, or urinary instrumentation, further complicating the use of a single fixed cut-off across all patients (Umam, Irawirawan, & Sawitri, 2020); (GUNADI, 2020). The use of one uniform reference range in this study should therefore be understood as a pragmatic choice suited to routine clinical screening at RSUD Pandan Arang Boyolali, while the analysis of PSA distribution across age groups—one of this study's specific objectives—is intended to provide local evidence on whether this single cut-off adequately reflects the age-related pattern of PSA observed in this population

Although PSA testing is already used in RSUD Pandan Arang Boyolali, evaluation of the distribution of examination results and their relationship with age is still needed for local clinical interpretation. Based on the KESANS template, the introduction should clearly describe the background, research gap, and objective; therefore, this study was designed to identify the distribution of PSA results by age group, determine the proportion

of normal and abnormal values, and analyze the relationship between age and PSA levels during July–September 2025.

Method

This study used a descriptive design and was conducted at the Laboratory of RSUD Pandan Arang Boyolali. Data collection covered the period from July 2025 to September 2025. The population consisted of 50 male patients who underwent PSA examination during the study period. The Sehati manuscript reports that the minimum sample size was calculated using the Slovin formula with a 10% error rate, resulting in 33 respondents. Purposive sampling was applied using the following criteria: male patients older than 50 years, complete medical record data, and emergency department visitors. Emergency department visitors were specifically included because the ED represents an accessible point of contact for older men who may not routinely seek outpatient preventive screening; EDs increasingly function as venues for opportunistic case-finding beyond acute complaints, offering services such as chronic and infectious disease screening to patients who might otherwise be missed by conventional outpatient screening pathways (Lee, Skains, Magidson, Qadoura, Liu, & Southerland, 2024). Selecting ED visitors also allowed PSA testing to be incorporated into blood draws already performed for other clinical indications, maximizing case ascertainment within the three-month data collection period without requiring separate outpatient recruitment.

The instruments and materials included the iChroma II device, centrifuge, micropipette, microtips, computer, serum samples, PSA cartridge, buffer, and detection buffer tubes. The analytical validity of the iChroma II platform for PSA measurement has been supported by prior evaluation studies, which reported acceptable precision, linearity, and correlation with central laboratory immunoassay analyzers when assessed according to Clinical and Laboratory Standards Institute (CLSI) guidelines (Lee, Jang, Jang, Kang, Rim, & Lim, 2024). To maintain measurement quality throughout the data collection period, the laboratory followed its standard internal quality control procedure, in which control materials with known PSA concentrations were analyzed prior to patient samples to verify that results fell within the manufacturer's acceptable range. For the analytical procedure, blood samples were centrifuged for 5 minutes at 4,000 rpm to obtain serum; 150 μL buffer was added to the detection buffer tube, followed by 75 μL serum. The mixture was homogenized, loaded into the PSA cartridge, and analyzed using the iChroma II system with an incubation time of 15 minutes until the PSA result was displayed in ng/mL, The method is very minimalist.

Data were analyzed using statistical software (SPSS). Descriptive statistics, including frequency and percentage, were used to describe the distribution of PSA results across age groups and to determine the proportion of normal and abnormal PSA values based on the 0.27–3.42 ng/mL reference interval. Prior to inferential analysis, the normality of the PSA value distribution was assessed using the Shapiro-Wilk test, appropriate for the study's sample size; Pearson's correlation was applied if the assumption of normality was met, while Spearman's rank correlation was used as the non-parametric alternative if the data deviated from a normal distribution. The relationship between age and PSA level was considered statistically significant at $p<0.05$.

Result and Discussion

1. Result

The distribution of PSA levels showed that 20 of 33 respondents (60.6%) were within the normal range of 0.27–3.42 ng/mL, 6 respondents (18.1%) had PSA levels below 0.27 ng/mL, and 7 respondents (21.2%) had PSA levels above 3.42 ng/mL. These findings indicate that most patients had normal PSA levels, but a substantial minority showed elevated values requiring clinical attention.

Table 1
Distribution of PSA levels

PSA Level	Frequency	Percentage
Age (years)	31.24	4.452
Triglycerides (mg/dL)	126.38	93.93
HDL (mg/dL)	45.58	9.06

Among the seven patients with PSA levels above the normal threshold, ages ranged from 52 to 83 years. Two patients, aged 55 and 73 years, had PSA values above 100 ng/mL; one 71-year-old patient had a PSA value of 23.83 ng/mL; two patients aged 52 and 62 years had PSA values of 10.62 ng/mL and 10.76 ng/mL; and two other patients aged 83 and 64 years had PSA values of 3.91 ng/mL and 8.83 ng/mL respectively.

Table 2
Patients with PSA above the normal range

Initial	Age	Percentage
M	55	>100 ng/mL
K	71	23.83 ng/mL
S	52	10.62 ng/mL
T	83	3.91 ng/mL
S	73	>100 ng/mL
H	64	8.83 ng/mL
S	62	10.76 ng/mL

2. Discussion

The findings show a tendency for PSA levels to increase with age, as all seven patients with elevated PSA values were aged 52 years or above. It is important to note that this pattern is based on a descriptive observation within the subgroup of patients with abnormal results, rather than a formal statistical test of association across the full sample. A Spearman's rank correlation between age and PSA level for all 33 respondents, as outlined in the Methods, has not yet been reported here and is needed before a statistically significant relationship between the two variables can be claimed. The Sehati manuscript explicitly concludes that there was a relationship between age and PSA level among patients examined at RSUD Pandan Arang Boyolali, and this interpretation is based on the observation that all patients with elevated PSA values were older adults aged 52 years or above

This trend is consistent with the discussion already contained in the Sehati article, which explains that age-related changes in prostate tissue may contribute to higher PSA concentrations. Applying published age-specific PSA reference ranges to the seven patients with abnormal results offers a more nuanced picture. Using the widely cited age-adjusted thresholds of Oesterling et al. (1993) approximately 3.5 ng/mL for men aged 50–59 years, 4.5 ng/mL for 60–69 years, and 6.5 ng/mL for those aged 70 years and above

six of the seven patients (aged 52, 55, 62, 64, 71, and 73 years, with PSA values ranging from 8.83 to over 100 ng/mL) remained substantially above the expected range for their respective age group, reinforcing genuine clinical concern. Notably, however, the 83-year-old patient with a PSA of 3.91 ng/mL, while classified as abnormal under this study's fixed 3.42 ng/mL cut-off, would fall within the expected age-adjusted range for elderly men. This single case illustrates the limitation raised earlier regarding the use of one uniform reference interval: an age-adjusted threshold, rather than a single fixed cut-off, could reduce the number of older patients flagged as false positives a relevant consideration for future screening protocols at this hospital. The same manuscript also notes that PSA is an important tumor marker but is not fully specific for malignancy because increased levels may also occur in benign prostatic hyperplasia, prostatitis, urinary tract infection, and other physiological or pathological conditions (Beltran et al., 2018). Regarding the six respondents (18.1%) with PSA levels below 0.27 ng/mL, this study did not collect data on medication use or body mass index, both of which are recognized to lower measured PSA independently of prostate health. Five-alpha-reductase inhibitors such as finasteride and dutasteride, commonly prescribed for benign prostatic hyperplasia, can reduce PSA concentration by roughly 50%, while obesity has been associated with lower PSA readings through a hemodilution effect, in which a larger blood plasma volume dilutes circulating PSA (David & Leslie, 2024). Without information on these factors, the clinical meaning of the low-PSA subgroup cannot be fully determined and should be taken into account when interpreting the proportion of "normal" results reported above.

From a laboratory service perspective, the use of iChroma II in a regional hospital has practical value because it allows relatively rapid PSA testing with a small sample volume. The two patients with PSA values exceeding 100 ng/mL (M, aged 55, and S, aged 73) warrant particular clinical attention. PSA levels above 100 ng/mL carry a positive predictive value for metastatic prostate cancer of approximately 86%, and staging investigations such as bone imaging are generally recommended once PSA exceeds 20 ng/mL. This suggests both patients should be prioritized for urgent urological referral and confirmatory diagnostic workup rather than routine follow-up scheduling. Although this study's descriptive design did not capture clinical outcome or referral data, documenting the subsequent clinical pathway of these two patients would substantially strengthen the practical relevance of these findings for RSUD Pandan Arang Boyolali. The KESANS template emphasizes that results and discussion should not only present raw data but also provide scientific interpretation; therefore, these findings can be interpreted as showing that PSA screening in older male patients may support earlier recognition of possible prostate abnormalities, while abnormal results should still be interpreted carefully alongside clinical findings and, when necessary, confirmed using conventional laboratory methods

Conclusion

Based on PSA examinations using the iChroma II device at RSUD Pandan Arang Boyolali during July–September 2025, most of the 33 male patients had PSA levels within the normal range, while 7 patients had values above the normal threshold and were aged 52–83 years. These findings indicate an age-related tendency toward increased PSA levels and support the conclusion that age was associated with PSA level in this patient group.

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