Original Article

A retrospective study of prostate-specific antigen and international prostate symptoms scores from participants at a men's health screening initiative in Trinidad

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Abstract

Background: This study describes the characteristics of men attending a primary health care screening initiative, determines the proportion of men who have elevated International Prostate Symptom Score (IPSS) scores and prostate-specific antigen (PSA) levels, and determines any correlation between these scores as indicators for benign prostatic hyperplasia (BPH) or prostate cancer. **Methods:** Data were collected from all patient records during men's health screening initiatives that occurred in December 2018, January 2019, and March 2019 in Trinidad and Tobago. A total of 350 medical records were analyzed to record patient demographics, PSA levels, and IPSS scores. Analysis of the data was performed with the use of Statistical Package for the Social Sciences software (version 27). **Results:** Most men who attended the screening initiative belonged to the 61–65 age group (20.57%), with more than half of the men being married (57.71%) and employed (52.57%) and of patients with comorbidities (17%), the most prevalent included hypertension (6%) and diabetes mellitus (3.7%). A mean PSA level of 2.94 ng/ml and a mean IPSS of 7.62 were recorded. Moreover, 11.5% of the males had elevated PSA levels (>4 ng/ml) and 32.9% had elevated IPSS levels (>8). There were correlations between PSA and IPSS values (r = 0.161 and $P = 0.006$). Age was a predictor of both IPSS and PSA values (r = 0.214, $P = 0.000$ and r = 0.192, $P = 0.000$, respectively). Among diabetic participants, a small but significant correlation between IPSS and diabetes was shown (r = 0.223, $P = 0.028$). As a predictor of elevated IPSS, diabetes had an odds ratio of 1.132 (95% confidence interval (CI): 1.021–1.255). **Conclusion:** Our findings are similar to those described in previous studies; however, further investigations are required to fully describe the relationship between PSA and IPSS. This may assist in advancing screening measures and improving health outcomes for men with BPH and prostate cancer. Primary care physicians should recognize the possible association between BPH and diabetes mellitus and offer appropriate screening where indicated.

Keywords: Benign prostatic hyperplasia, international prostate symptom score, primary care, prostate cancer, prostate-specific antigen, screening

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Introduction

Prostate cancer is the leading cause of cancer-related deaths among males in the Caribbean region at 18.4–47.4%.[1] This was documented in Trinidad in 2005[2] and again in 2018[3] at

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41.7%. Benign prostatic hyperplasia (BPH) is a prevalent benign condition that affects 50–80% of men above the age of 50,[4] which results in 1/3 of patients developing lower urinary tract symptoms (LUTS) with the International Prostate Symptom Score (IPSS) being positively and linearly related to PSA but a poor predictor.[5]

Prostate-specific antigen (PSA) levels and IPSS are used as initial screening tools for prostate cancer and BPH.[2] PSA levels of 0.0–2.5 ng/dL are considered normal, whereas values above 4.0 ng/dL indicate cause for concern. IPSS is comprised of the following eight questions that quantify BPH symptoms: frequency of urination, urgency, intermittency, weak stream, straining, nocturia, incomplete emptying, and quality of life of the patient. IPSS is scored numerically; a total score of 0–7 indicates mild symptoms, 8–19 indicates moderate symptoms, and 20–35 indicates severe symptoms. Park *et al.*[6] demonstrated a significant correlation between PSA and IPSS although the results were not definitive. They also found PSA to be a strong predictor of prostate volume.

The most common type of cancer overall, and among men, is prostate cancer, as this accounts for 22% of all cancers locally.[7] It is estimated that about one in nine men will be diagnosed with prostate cancer, and it is diagnosed at an average age of 66 years.[8] In Trinidad and Tobago, the incidence rate is 64.0 per 100,000 for a population of 1.3 million.[7] In 2015, the mortality rate due to prostate cancer in the Caribbean was estimated to be 50 per 100,000.[9] Additionally, BPH has a prevalence of 8%, 50%, and 80% within the fourth, sixth, and ninth decades of men's lives.[10] For Trinidad and Tobago, the prevalence is 6–10% in men 50 years and above.[11]

A national study revealed that the average age of diagnosis of prostate cancer was 71 years of age and that prostate cancer incidence was higher among African men than among other ethnic groups. It was determined that there was a three-fold higher risk of death associated with a Gleason score of eight to 10.[12]

Regionally, within the Caribbean region, a higher prevalence of diagnosed prostate cancer was found among married men and men with a lower level of education.[9]

An Iranian study investigated the specificity and sensitivity of IPSS in screening for prostate cancer. It reported that the specificity and sensitivity of IPSS scores were 59.4% and 78%, respectively. Patients with prostate cancer had a significantly higher total IPSS score and the IPSS mean score in different categories of severity was identified to be higher for the prostatic cancer patients but within the severe category, it was significantly higher.[13]

A PSA profiling study conducted in a multiethnic Asian setting reported that Indian men had a lower median PSA level. Chinese and Malay men were reported to have a higher prostate volume compared to that of the Indians. Caucasians had higher median PSA levels and prostate volumes. They concluded that ethnicity and age were significant variables that determined baseline median PSA levels.[14]

There is at present no definitive association between BPH and prostate cancer. However, it is likely that although BPH may not make prostate cancer more likely to occur, it may increase the chance of diagnosing an incidental cancer.[15]

Primary care physicians encounter challenges in determining the utility and interpretation of urological screening tests such as PSA and IPSS. Indeed, it has been reported that general practitioners (GPs) have a general ambivalence about the use of PSA including when to use it, how to interpret the results, and when to refer to specialist health services. The use of PSA sometimes generates problems rather than solving them.[16]

Furthermore, the IPSS questions may be difficult to understand, even for men with a relatively high level of education, patients often ask the doctor or nurse for an explanation of the questions while completing the form. This invariably introduces the risk of influencing the patient's responses.[17] This underscores the importance for primary care physicians to have a good understanding of how the IPSS is to be scored and not introduce any biases when called upon to assist patients.

Methods

This study analyzed data extracted from the medical records of 350 men attending a men's health initiative in the geographic area of North-Central Trinidad. The sample included all men who participated in the screening events, with no exclusions. Demographic data collected included age, marital status, occupation, blood pressure, weight, BMI, urine analysis including the presence of protein and blood, IPSS scores, PSA values, and random blood sugar tests. This study related the demographic variables to the IPSS scores and PSA values to determine correlations and associations and the proportion of men in the sample size that were potentially at risk for developing BPH and prostate cancer. The mean PSA and IPSS scores were calculated to identify possible factors associated with elevated PSA and IPSS scores.

Data were analyzed using Statistical Package for the Social Sciences (SPSS) (version 27) to generate descriptive statistics including measures of frequency, central tendency, variability, and correlation. Inferential statistics including Chi-square testing were also performed.

This retrospective study was reviewed and approved by the University of the West Indies Ethics Committee. Ref: CREC-SA.0610/11/2020.

Results

Most men who attended the screening initiative belonged to the 61–65 age group (20.57%), with more than half of the men

being married (57.71%) and employed (52.57%). Out of the 350 subjects, the age group 61–65 years accounted for the largest number of participants (20.57%) followed by the groups 51–55, 56–60, 46–50, 41–45, 66–70, 71–75, 36–40, 76–80, 26–30, 86–90, 31–35, and 21–25, which had 14.29%, 14%, 13.71%, 12.86%, 11.71%, 4.29%, 4%, 1.71%, 1.14%, 0.57%, 0.57%, and 0.57% of the participants, respectively. See Figure 1 below.

52.57% of the participants were employed, 28.86% were unemployed, and 18.57% did not say. See Figure 2 below.

Regarding the marital status of the participants, 57.71% were married, 21.71% were single, 7.71% were in common law union, 7.14% were divorced, 2.86% were separated, 2% were widowed, and 0.86% did not say. See Figure 3 below.

With respect to comorbidities, 6% had hypertension, 3.71% had diabetes mellitus, 2.29% had glaucoma, and 1.43% had an eye disorder. Less than 1% had confirmed diagnoses of BPH and prostate cancer. In addition, 0.86% had BPH and 0.57% had prostate cancer. See Figure 4 below.

Figure 5 below shows that the majority of the participants had mild IPSS with safe PSA levels (45.14%) followed by moderate IPSS and safe PSA levels (23.43%), and severe IPSS and safe PSA levels (4%). There was some missing data, however, as 16.86% had no record for either IPSS or PSA levels.

A mean PSA level of 2.94 ng/ml and a mean IPSS of 7.62 was recorded. In addition, 11.5% had elevated PSA levels (>4.0 ng/ml) and 32.9% had elevated IPSS levels (>8).

There was a notable correlation between PSA and IPSS values (r = 0.161 and P = 0.006). Age was a predictor of PSA (r = 0.192, P = 0.035) and was also significantly associated with IPSS scores (r = 0.214, P < =0.05). Regression analysis revealed that for every increase in age by one standard deviation, a rise in IPSS by 0.22 standard deviations occurs. Moreover, 16.86% of participants had no record for either IPSS or PSA levels due to missing data.

Among diabetic participants, a small but significant correlation between IPSS and diabetes was shown (r = 0.223, P = 0.028). As a predictor of elevated IPSS, diabetes had an odds ratio of 1.132 (95% confidence interval (CI): 1.021–1.255). No correlation was found between PSA levels and diabetes.

No statistically significant correlations were found between IPSS and weight, PSA and weight, IPSS and hypertension, and PSA and hypertension.

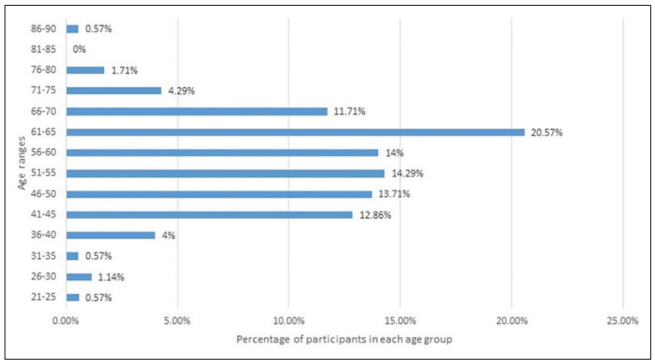

Figure 1: Bar graph showing the percentage of participants in each age group

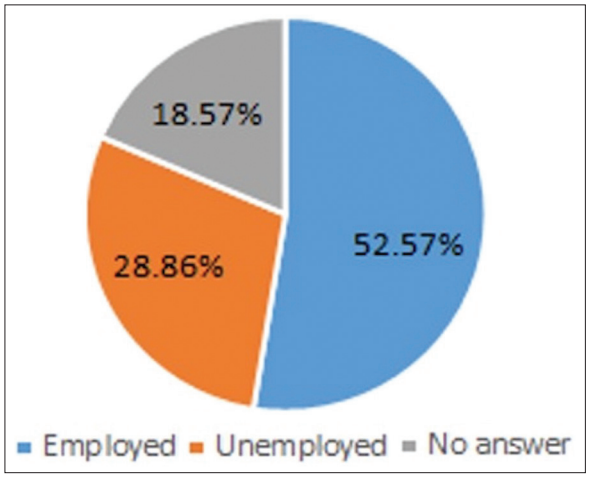

Figure 2: Pie chart showing the employment status of the participants

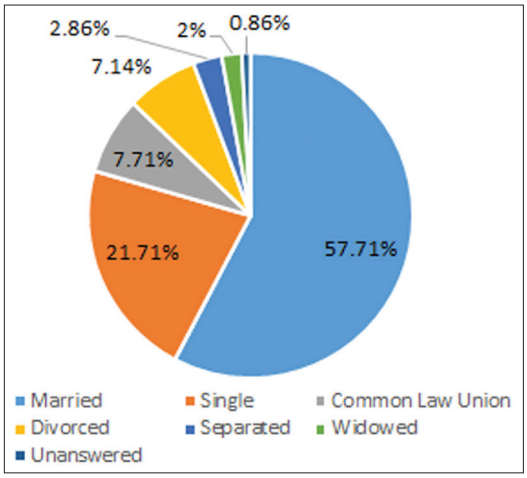

Figure 3: Pie chart showing marital status among the participants

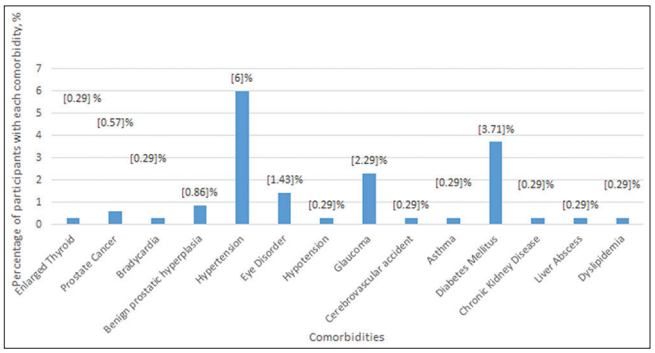

Figure 4: Bar graph showing the percentage of participants with comorbidities

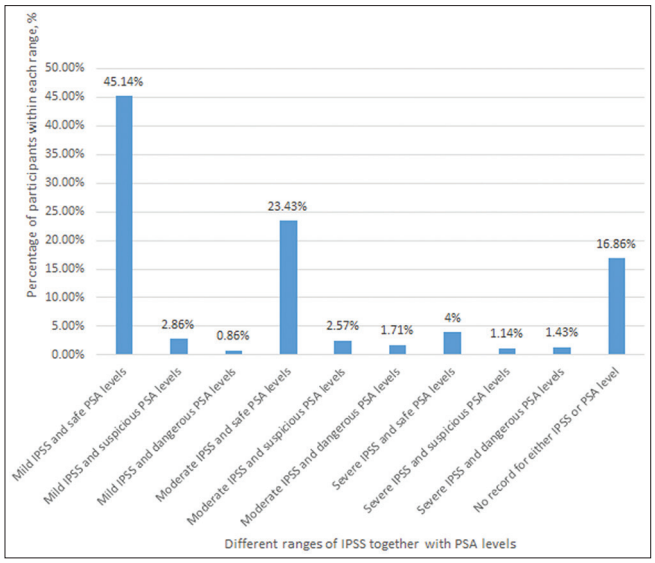

Figure 5: Bar chart showing the percentage of participants in relation to IPSS and PSA categories

Mild IPSS	0–7
Moderate IPSS	8–19
Severe IPSS	20–35
Safe PSA level	0–4 ng/ml
Suspicious PSA level	4–10 ng/ml
Dangerous PSA level	>10 ng/ml

Discussion

Our findings are supported by those of Oesterling *et al.*[18] which demonstrated evidence that PSA level is directly correlated with age. The associations between PSA score and age (r = 0.192, $P = 0.035$) and IPSS and age (r = 0.214, $P = 0.035$) are consistent with the findings of Berges and Oelke,[19] who recorded increasing IPSS scores with age in German men.

Our findings are supported by those of Park *et al.*,[6] in which IPSS scores did not demonstrate a high correlation level with PSA. (r = 0.161, $P = 0.006$). The performance of the Shapiro-Wilk and Kolmogorov-Smirnov tests revealed that IPSS ($P < 0.05$SW, $P < 0.05$KS) and PSA ($P < 0.05$SW, $P < 0.05$KS) were not normally distributed, unlike the data used in the previously mentioned study, which was analyzed after a logarithmic transformation to warrant a normal distribution. In our study, the mean IPSS was 7.62 ± 6.23 and the mean PSA score was 2.94 ± 10.21. Moreover, 27.7% of men had an IPSS greater than eight, and 11.5% had a PSA score greater than four. Our findings are also consistent with a recent Swedish study that looked at the association between the IPSS and prostate cancer in a population-based sample of men ($n = 45,595$) aged 50–69 years. It concluded that their data did not support any clinically meaningful association between LUTS and prostate cancer.[20]

Interestingly, a recent cross-sectional hospital-based study of 100 men attending urology clinics in Sudan reported a significant correlation between IPSS score and PSA, prostate volume, post-void residual volume, and quality of life. The IPSS score was not age-related.[21]

A small but significant correlation between IPSS and diabetes was observed (r = 0.223, $P = 0.028$). This observation is not unusual, as diabetes is commonly seen as a comorbidity in men with BPH and LUTS.[22]

A study exploring the effects of interleukin-1 suggested that the alteration of sex steroid hormone metabolism caused by both diabetes and obesity may lead to "pro-inflammatory" conditions in the entire body, resulting in the release of chemokines that may contribute to the enlargement of the prostate.[23] In our study, no association was found between PSA scores and diabetes. This is at variance with a previous that demonstrated that men with diabetes tend to have lower PSA scores.[24] This may be because of the much smaller sample size of 350 men compared to 1,034,074 men in their study.

Neither the IPSS and hypertensive status of the patient nor the PSA and hypertensive status of the patient were significantly correlated. However, Hwang *et al.* reported that men with hypertension were more likely to have a higher IPSS than men without.[25] Another study done by Hong *et al.* reported that mean IPSS scores were notably higher in Korean patients with hypertension than in normotensive men.[26] The differing results may be the result of missing data or the non-disclosure of hypertensive status.

The mortality rate for prostate cancer in the Caribbean is higher than in many developed countries.[27] The American Academy of Family Physicians advises that screening for prostate cancer using PSA may prevent mortality from prostate cancer for a small number of men. Whether this potentially small benefit in mortality outweighs the potential harm is dependent on the values and preferences of individual men. Therefore, for men who express a desire for prostate cancer screening, it should only be performed following a discussion of the potential benefits and harms.[28]

In relation to population-based prostate cancer screening, a Swiss study suggested that men with a positive family history are at increased risk for low-grade but not aggressive prostate cancer. These findings suggest a potential role for identifying those with positive family histories of prostate cancer and factoring this into the decision to screen or not screen.[29]

With the Caribbean region having one of the highest prostate cancer-specific mortality rates in the world, it is critical that family physicians be aware of the magnitude of this problem and engage male adults, particularly those at increased risk, in a discussion about the benefits and harms of screening.

Some of the limitations of the study included the sample size, which was relatively small. The small sample size compounded

by missing data from medical records may reduce the validity of our findings and the magnitude of the correlations.

Furthermore, it is important to note that the participants of this study are not necessarily representative of all men who are at risk for prostate cancer or BPH. The participants for this study voluntarily participated in a screening initiative, which may suggest that they are more likely concerned about their health, thereby contributing to the possibility of self-selection bias. Potential confounders that were not determined such as BMI, ethnicity, presence of other comorbidities, family history of prostate cancer, and history of medication use, may also limit the findings in the study. Each of these factors can influence both PSA or IPSS scores. High PSA and IPSS scores may be directly related to the ethnicity of the participants in the study, artificially influencing the findings in the study. Medications may improve or worsen symptoms of BPH, thus influencing IPSS and PSA scores, rather than the symptoms being due to BPH/cancer.

Conclusion

Our findings showed that PSA score and IPSS are significantly associated with age where there is a direct correlation between PSA and age. However, IPSS scores did not demonstrate a high correlation level with PSA. Although IPSS and diabetes mellitus have shown a small but significant correlation, PSA levels and diabetes were not correlated.

This study could provide the basis for determining insights into the long-term prognosis of participants based on their initial PSA levels and IPSS scores. By following up with participants over time, researchers may identify associations between baseline measurements and disease progression, recurrence, or overall survival rates. This study could also assist in exploring potential health disparities in the relationship between PSA levels, IPSS scores, and prostate-related outcomes. By considering demographic factors such as age and race, researchers may identify disparities in disease prevalence, severity, or treatment outcomes, thereby highlighting areas for targeted intervention.

Primary care physicians should recognize the possible association between BPH and diabetes mellitus and offer appropriate screening where indicated. The high prostate cancer mortality within the Caribbean region dictates that primary care physicians offer screening with PSA whenever benefits outweigh risks and in accordance with best practice screening guidelines, and taking into consideration risk factors such as family histories.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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