

## Age-Stratified Mean Values of Prostate Volume Among Filipino Males in a Tertiary Hospital: A Single Center Study

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**Introduction and Objective:** Differences in ethnicity and geographical factors may have an effect in the characteristics of the prostate in men. To date, there is no demographical data regarding the average prostate volume among Filipino males stratified per age.

**Methods:** Retrospectively collected data from 3568 consecutive patients who had an ultrasound of the prostate from January 1, 2015 to December 31, 2016. Age and prostate volume by ultrasound were collected. Patients who had previous prostate surgery were excluded, and for uniformity of results, only patients who underwent transabdominal prostate ultrasound were included.

**Results:** Patients were stratified into the following age groups: 29 and below, 30 to 39, 40 to 49, 50 to 59, 60 to 69, 70 to 79, and 80 and above, and present results showed that the mean values of prostate volume were  $15.8 \pm \text{SD } 5.4$ ,  $19.6 \pm \text{SD } 5.7$ ,  $22.1 \pm \text{SD } 7.3$ ,  $28.0 \pm \text{SD } 11.0$ ,  $34.0 \pm \text{SD } 17.9$ ,  $39.6 \pm \text{SD } 28.13$ ,  $39.2 \pm \text{SD } 23.3$ , respectively.

**Conclusion:** The mean prostate volume among Filipino males increases with age and the threshold for an enlarged prostate might need an adjustment in dealing with Filipino patients.

**Key words:** Prostate size, age factors, cross-sectional studies

### Introduction

Men's health has taken center stage in the last decade in the Philippines and the birth of the Philippine Society for the Study of the Aging Male Foundation Incorporated (PhiSSAM) in 2000 has invited more specialists in a multi-professional level. Besides erectile dysfunction from among sexually active males, the concern on prostate enlargement and cancer top the list of concerns by the aging men. Equally disturbed with erectile problems, lower urinary tract symptoms (LUTS) due to Benign Prostatic Enlargement (BPE) is a bothersome condition that prompts patients to seek

consult for better understanding and treatment. This common condition of BPE affects men as early as 40 years of age. Studies regarding the correlation between prostate volume and lower urinary tract symptoms showed a statistically significant correlation.<sup>1,2</sup> Although not all male lower urinary tract symptoms are caused by an enlarged prostate, it is still one the most common causes for lower urinary tract symptoms.<sup>2</sup>

Aside from age and its relationship to BPE, ethnicity and environmental factors may play a role in prostate volume.<sup>3,4</sup> In a study by Choi, et al. in 2002, they measured the prostate volumes of different ethnic groups, namely Koreans, African-

American, Caucasian and Hispanic, where they found out that the mean prostate volume was  $34.4 \pm 11.8$ ,  $39.3 \pm 9.6$ ,  $38.5 \pm 7.8$ , and  $38.1 \pm 7.9$  for each ethnic group, respectively.<sup>5</sup> Studies have been conducted to determine the relationship between the prostate size and age, but no study has been done in the Philippine setting.

There is a steady increase in prostate imaging which collaborates with the effective awareness campaign on the aging male and bothersome symptoms of LUTS and BPE. Prostate imaging through ultrasound can be done transabdominally or transrectally. Both methods have a strong correlation with prostate volume measurement, and one can be an alternative to the other depending on patient characteristics.<sup>6</sup> For example, transabdominal ultrasound is more appropriate for patients with anal disease, while transrectal ultrasound may be more appropriate for obese patients. Another study by Konduru, et al. showed that there is a significant correlation between transrectal and transabdominal ultrasound measurement of the prostate up to 100 grams.<sup>7</sup> SLMC-QC, more than 90% of prostate ultrasounds are done transabdominally, and for uniformity of results, the authors opted to exclude those patients who had a transrectal ultrasound of the prostate. The objective of this study was to determine the age-stratified mean values of prostate volume among Filipino males in a tertiary hospital.

## Methods

This study was approved by the hospital's Institutional Ethics Review Committee. All information and records retrieved from the medical records and statement of accounts were kept in confidentiality by the principal investigator.

This retrospective cross-sectional study gathered and reviewed all Filipino male patients who underwent prostate ultrasound from January 1, 2015 to December 31, 2016. All patients who underwent transabdominal and/or transrectal ultrasound studies of the prostate for any reason at SLMC-QC with no age limitation were included. Data were collected through review of medical records. Patients who had a transrectal ultrasound done and patients who had previous prostate

surgery were excluded from the study. For patients with repeat ultrasound studies, only the first ultrasound reading was included. Information gathered from all qualified patients included the age of the patient and the transabdominal ultrasound measurement of the prostate. The ultrasound machines used were the following: Siemens Acuson Antares, Siemens Acuson S2000 Hitachi Hi-Vision Preirus and Hitachi Hi-Vision Aviuss. Prostate volume was measured and obtained with a full bladder with the patient in a supine position by a certified radiology technician trained in the use of a Siemens and Hitachi ultrasound machine. Using the formula of a prolate ellipsoid ( $\pi/6 \times$  transverse  $\times$  craniocaudal  $\times$  anteroposterior), the prostate volume was reported in grams.

Using data from the study of Chung, et al.<sup>8</sup>, sample size was calculated using the following parameters: Mean prostate size = 30.5, standard deviation = 10.3, alpha = 0.05, with a power of 0.80. Sample size computed was 92 per age stratification assuming a 10% difference from the standard value of 30.5. With 7 age stratifications, estimated sample size was 644. Sample size was computed using Stata se version 14.2 for Windows. Descriptive statistics was used to summarize the demographic and clinical characteristics of the patients. Frequency and proportion were used for categorical variables, median and inter quartile range for non-normally distributed continuous variables, and mean and SD for normally distributed continuous variables.

## Results

From January 1, 2015 to December 31, 2016, a total of 3568 patients underwent prostate ultrasound at SLMC-QC. Excluded from the study were patients who have had previous prostate surgery (n=42), and patients who underwent transrectal ultrasound (n=52). Patients who had multiple ultrasound of the prostate (n=723) within the study period were entered only once with their first volume determination recorded. A total of 2751 patients were analyzed (Figure 1). The mean age of the study population was  $52.83 \pm$  SD 14.03.

Patients were divided into 7 age stratifications: Group 1: 29 years old and below; Group 2: 30 to 39 years old; Group 3: 40 to 49 years old; Group 4: 50

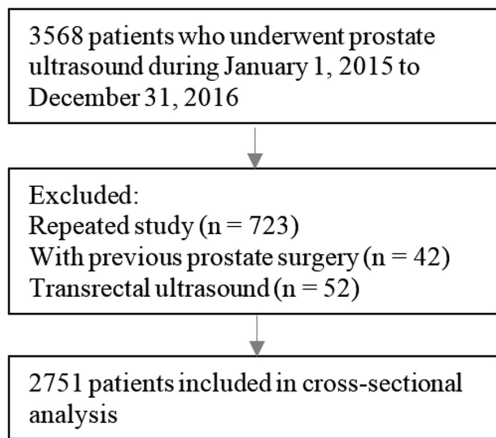


Figure 1. Study population

to 59 years old; Group 5: 60 to 69 years old; Group 6: 70 to 79 years old; and Group 7: 80 years old and above. There were 151 patients in Group 1 with a mean prostate size of 15.8 grams  $\pm$  SD 5.4 and a median size of 15 grams. For Group 2, a total of 314 patients were included with a mean prostate size of 19.6 grams  $\pm$  SD 5.7 and a median size of 19 grams. Group 3 had the total of 585 patients included in the study with a mean prostate size of 22.1 grams  $\pm$  SD 7.3 and a median size of 21 grams. Group 4 has the highest number of patients, with a total count of 824, included in the study. The mean prostate size for Group 4 was of 28.0 grams  $\pm$  SD 11.0 with a median size of 26 grams. Group 5 has a total of 612 patients with mean prostate size of 34.0 grams  $\pm$  SD 17.9 and a median size of 31 grams. A total of 183 patients were included in Group 6 with a mean prostate size of 39.6 grams  $\pm$  SD 28.13 and a median size of 32 grams. Group 7 had 82 patients included in the study with a mean

prostate size of 39.2 grams  $\pm$  SD 23.3 and a median size of 32 grams (Table 1).

Further analysis of the data of the present study showed that there is a significant relationship between age and prostate size. The change in prostate size per unit change in age was calculated as  $y = a + bx$ , where  $y$  is prostate size, and  $x$  is age. The results showed that prostate size increases by 0.47 grams ( $p < 0.001$ , CI 95% 0.44 – 0.51) per 1 year increase in age. In sub-group analysis, prostate size increased by 0.408 ( $p < 0.001$ , CI 95% 0.236 – 0.527), 0.427 ( $p < 0.001$ , CI 95% 0.205 – 0.649), 0.401 ( $p < 0.001$ , CI 95% 0.191 – 0.611), 0.644 ( $p < 0.001$ , 0.382 – 0.905), 0.115 ( $p = 0.649$ , CI 95% -0.382 – 0.612), 1.473 ( $p = 0.46$ , CI 0.029 – 2.92), and 0.156 ( $p = 0.795$ , CI 95% -1.04 – 1.35) per 1 year increase in age in Group 1, 2, 3, 4, 5, 6 and 7, respectively (Table 2).

## Discussion

Normal prostate size in grams is approximately 25 grams and most of our references are either American or European. A number of Japanese, Chinese, Korean or Indian studies have been published and almost have the same findings as that of the American and European counterparts. In the review of most literature, the overall average prostate size of the study population is reported and resembles the same normal value as 25 grams as a prostate size across ethnicity.

The overall average prostate size among the study population was 27.56  $\pm$  15.39, which is comparable to reported normal size of the prostate gland on ultrasound which is approximately 25 grams.<sup>9</sup> The overall prostate size increases by

Table 1. Age-stratified mean and median values of prostate volume.

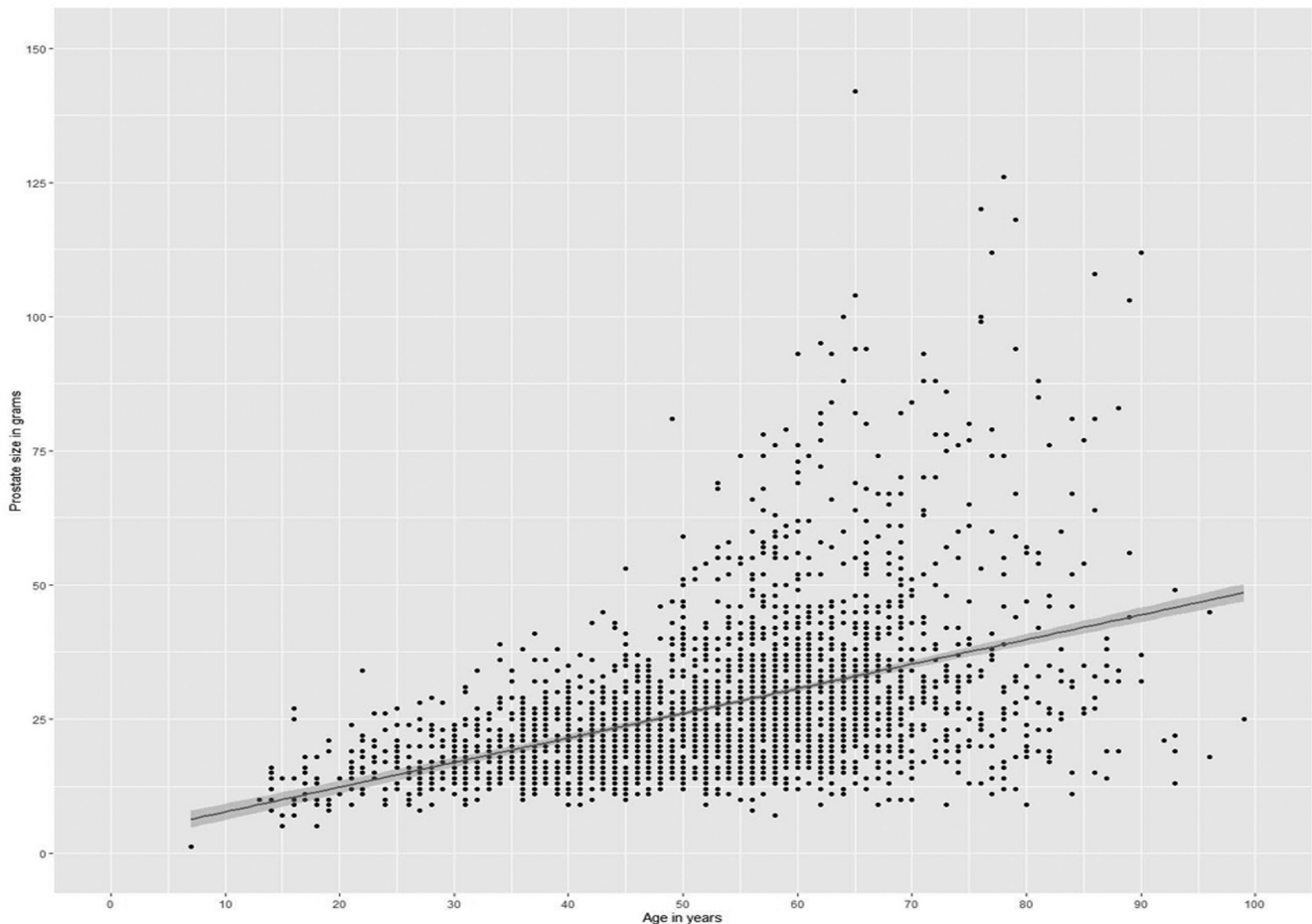
| AGE GROUP in years<br>(N = 2751) | MEAN PROSTATE SIZE<br>(in grams) | MEDIAN<br>(in grams) |
|----------------------------------|----------------------------------|----------------------|
| Group 1: 29 and below (N = 151)  | 15.8 $\pm$ SD 5.4                | 15                   |
| Group 2: 30 to 39 (N = 314)      | 19.6 $\pm$ SD 5.7                | 19                   |
| Group 3: 40 to 49 (N = 585)      | 22.1 $\pm$ SD 7.3                | 21                   |
| Group 4: 50 to 59 (N = 824)      | 28.0 $\pm$ SD 11.0               | 26                   |
| Group 5: 60 to 69 (N = 612)      | 34.0 $\pm$ SD 17.9               | 31                   |
| Group 6: 70 to 79 (N = 183)      | 39.6 $\pm$ SD 28.13              | 32                   |
| Group 7: 80 and above (N = 82)   | 39.2 $\pm$ SD 23.3               | 32                   |

0.47 grams per one year increase in age. Present result is similar to the study of Chung, et al. with a 0.4 grams per year. There was also a statistically significant relationship between prostate size and age in Groups 1 to 4. (Table 2) However, in Group 5 and 7, the relationship was not statistically

significant. In Group 6, the relationship was also statistically significant but the p-value was close to the cut-off, so this should be interpreted with caution. This shows that the direct relationship between age and prostate size is seen only up to age of 59 in the present study population. (Figure 2)

**Table 2.** Relationship between age and prostate size per age group.

| AGE GROUP in years<br>(N = sample size) | Relationship between<br>age and prostate size<br>(Beta-Coefficient) | p-value | 95% Confidence Interval |
|---|---|---------|-------------------------|
| Group 1: 29 and below (N = 151)         | 0.408   | <0.001  | 0.236-0.579             |
| Group 2: 30 to 39 (N = 314)             | 0.427   | <0.001  | 0.205-0.649             |
| Group 3: 40 to 49 (N = 585)             | 0.401   | <0.001  | 0.191-0.611             |
| Group 4: 50 to 59 (N = 824)             | 0.644   | <0.001  | 0.382-0.905             |
| Group 5: 60 to 69 (N = 612)             | 0.115   | 0.649   | -0.382-0.612            |
| Group 6: 70 to 79 (N = 183)             | 1.473   | 0.046   | 0.029-2.92              |
| Group 7: 80 and above (N = 82)          | 0.156   | 0.796   | -1.04-1.35              |
| Overall                                 | 0.47  | <0.001  | 0.44-0.51               |



**Figure 2.** Scatter plot of prostate size and age among study population.

According to Brent, et al.<sup>9</sup>, prostate sizes larger than 30 grams are considered enlarged. To date, this is the reference value that we use as a cut-off size for prostate enlargement in our institute. Furthermore, we computed in our study for the percentage of patients per age group with prostate size larger than 30 grams (Table 1). In the age group 60-69, more than 50% already have an enlarged prostate gland having 30 grams as the reference value. Worldwide autopsy-proven histological prevalence of benign prostatic enlargement increases at age 40 to 45 years old, reaching 60% at 60 years old and 80% at 80 years old.<sup>10</sup> De ridder, et al.<sup>11</sup> in their epidemiological study found that 41% of men who visited a general practitioner 40 years old and above were bothered with LUTS. All these data highlight the prevalence of LUTS and BPE in men aged 40 years and above. On the other hand, men in the age group of 30-39 years old need not seek consult for prostate evaluation as they are qualified as less likely to have significant prostate enlargement that will warrant early evaluation. The mean prostate size for the age group 30-39 in the present study is 19.6 grams  $\pm$  SD 5.7 with a median size of 19 grams. As age, prostate size, symptom score, flow rate and post void residual urine are collectively used in evaluating patients with lower urinary tract symptoms, it is imperative that appropriate normal values be established. With 40 years of age as a cut-off for significant BPE and bothersome symptoms, the age group of 30-39 in the present study, having a mean prostate size of 19.6 grams, may be considered as a normal prostate size among Filipinos. The significance of early diagnosis and early intervention is often overlooked, and its benefits should be explained to the patients. A study by Alcaraz, et al. showed statistically significant improvements in quality of life and symptoms when patients were started with medical treatment compared to watchful waiting.<sup>12</sup> Moreover, Mishriki, et al.<sup>13</sup> also concluded that after transurethral resection of the prostate, quality of life and bothersome scores were significantly improved and was associated with long-term patient satisfaction.

Present data may help Filipino physicians to put into perspective their patients' prostate size in relation to other patients in the same age

group. For example, a 45-year old patient who comes into a clinic with a prostate ultrasound measurement of 25 grams, based on present data, he is at the 50th to 75th percentile for prostate size both in his age group of 40 to 49 years old and overall (Table 2).

Strengths of this study rest on a large number of participants. A large sample size provides more accurate mean values and decrease the margin of error. It can also help identify outliers that can skew data. Additional studies can be done to correlate this data with other patient factors such as PSA, uroflowmetry results or International Prostate Symptoms Score (IPSS). Prostate size is only one of the many factors that can have an effect on the decision-making process in the treatment of BPE and correlating it with the other factor can help in making a more objective treatment algorithm for BPE.

## Conclusion

The mean prostate volume among Filipino males increases with age and the threshold for an enlarged prostate might need an adjustment in dealing with Filipino patients.

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