

## Research Article

## Changes in diagnosis rate and treatment trends of benign prostatic hyperplasia in Korea: A nationwide population-based cohort study

Do Kyung Kim<sup>a</sup>, Jae Joon Park<sup>a</sup>, Won Jae Yang<sup>a</sup>, Seung Whan Doo<sup>a</sup>, Jae Heon Kim<sup>a, b</sup>, Yun Seob Song<sup>a, \*</sup><sup>a</sup> Department of Urology, Soonchunhyang University Seoul Hospital, Soonchunhyang University Medical College, Seoul, Korea<sup>b</sup> Urological Biomedicine Research Institute, Soonchunhyang University Seoul Hospital, Seoul, Korea

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## ABSTRACT

**Purpose:** This study aimed to evaluate benign prostatic hyperplasia (BPH) diagnosis rate and the changing landscape of medical and surgical management of BPH over the last decade using national population data of South Korea.

**Methods:** The present study analyzed data of patients diagnosed with BPH (N40) who underwent medical treatment or surgery in 3% of the national patient sample of the Health Insurance and Review Assessment database each year between 2012 and 2018. The primary outcome was the proportion of medical and surgical treatment for BPH. It was evaluated each year between 2012 and 2018. Secondary outcomes included total BPH diagnosis rate in each year of the study period. BPH diagnosis rate by age group was evaluated. The proportion of medical and surgical treatment for BPH according to the type of medical institution was investigated.

**Results:** The proportion of surgical treatment was 1.2% in 2012, 1.0% in 2013, 1.0% in 2014, 0.9% in 2015, 0.8% in 2016, 0.7% in 2017, and 0.8% in 2018, showing a progressive overall decrease from 2012 to 2018. The rate of surgical treatment for BPH increased with increasing age during the study period, showing a progressive overall increase (from 9,202 per 100,000 men in 2012 to 11,610 per 100,000 men in 2018). The number of patients with BPH was increased steadily from 2012 to 2018 in all age groups. The rate of surgical treatment in tertiary referral hospitals was the highest during the study period, followed by that in general hospitals, hospitals, and clinics.

**Conclusions:** In Korea, the diagnosis rate of BPH was steadily increasing during the study period. Overall surgical treatment gradually decreased compared with an increase in medical treatment among all treatments for BPH. Thus, a comprehensive treatment plan for BPH should be established considering this trend.

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## 1. Introduction

Benign prostatic hyperplasia (BPH) is defined as pathological hyperplasia of prostate epithelial and stromal cells. It is the most common urologic disease in elderly men. The proportion of affected male patients increases with an increasing age.<sup>1,2</sup> BPH and the resulting lower urinary tract symptoms (LUTS) affect men as they age, thus negatively affecting their quality of life.<sup>3,4</sup> The prevalence

of LUTS is approximately 30%–40% in individuals aged >50 years based on International Prostate Symptom Score.<sup>5</sup> Watchful waiting, medical therapy, and surgery are currently recommended treatments for BPH.<sup>6</sup>

Historically, transurethral resection of the prostate (TURP) has been the only trustworthy treatment for symptomatic or obstructive BPH.<sup>7</sup> After the introduction of alpha-blockers (ABs) into the market, surgical management of BPH has shown a rapid decline.<sup>7</sup> Surgical management of BPH was stabilized for a short time because of the development of a new laser technology.<sup>8,9</sup> However, it has declined again since 2005.<sup>8</sup> Medical treatment for LUTS secondary to BPH covers a wide range, including the use of ABs, 5 $\alpha$ -reductase inhibitors (5ARIs), antimuscarinics,  $\beta$ 3-agonists, and phosphodiesterase type 5 inhibitors.<sup>10,11</sup> In surgical management of

\* Corresponding author. Department of Urology, Soonchunhyang University Seoul Hospital, Soonchunhyang University Medical College, 59, Daesagwan-ro, Yongsan-gu, Seoul, Korea.

E-mail address: [yssong@schmc.ac.kr](mailto:yssong@schmc.ac.kr) (Y.S. Song).

BPH, TURP has historically been the “gold standard.” It is still widely practiced. Open prostatectomy is also effective. However, because of the trend toward a minimally invasive surgery, the number of TURP performed is gradually decreasing. Transurethral incision of the prostate and laser prostatectomy including photoselective vaporization of the prostate (PVP) and holmium:YAG laser enucleation of the prostate (HoLEP) are less invasive alternatives to TURP.<sup>5</sup>

Morton et al. have examined national trends of medical and surgical treatments for BPH using Australian population data from 2000 to 2018, showing that the overall treatment for BPH has increased because of medical treatment and surgical alternatives to TURP.<sup>10</sup> Treatment is also influenced by several factors such as changes of surgery indication, surgeon attitudes, financial conditions of patients, demographic factors (rural vs. major cities), and clinical settings (inpatient vs. outpatient).<sup>8,12</sup> As time changes, the trend of BPH treatment is also changing. Recognizing such change is very important for establishing a future treatment strategy for BPH. However, few studies have investigated the trend of BPH treatment using national population data in South Korea.

Therefore, the objective of this study was to investigate the BPH diagnosis rate and the changing landscape of medical and surgical management of BPH over the last decade using national population data in South Korea. The present study also evaluated the overall prevalence and treatment trends of BPH through a survey of BPH diagnosis rate and treatment patterns for each year from 2012 to 2018 using the National Health Insurance cohort data in South Korea. In addition, differences in proportions of treatment methods according to clinical setting were studied.

## 2. Materials and methods

### 2.1. Health insurance and review assessment database and study ethics

The National Health Insurance System is a mandatory comprehensive health insurance in South Korea, covering almost 98% of the total population. Health Insurance and Review Assessment (HIRA) data are created in the process of reimbursing claims for medical services under the National Health Insurance System in South Korea.<sup>13</sup> The HIRA includes comprehensive data on health care services such as treatments, medicines, procedures, and diagnostics for 98% of the population or more. Its data collection is very complete, as 99% of claims are electronically collected, with little chance of missing claims.<sup>13</sup> This study used 3% of the national patient sample of the HIRA database. The present study was conducted in accordance with the principles of the Declaration of Helsinki. It was approved by the Institutional Review Board of Soonchunhyang University Seoul Hospital (No. 2019-05-005).

### 2.2. Study cohort and treatment for BPH

The study cohort consisted of patients diagnosed with BPH (N40) who underwent medical treatment or surgery in 3% of the national patient sample of the HIRA database each year between 2012 and 2018. Patients diagnosed with BPH who did not undergo any treatment were excluded. Patients who received treatment without a diagnosis of BPH were also excluded.

Billing codes of prescribed medications and operation in the HIRA system are shown in [Supplementary Table 1](#). Medical treatment consisted of alpha-adrenoreceptor antagonists, 5ARIs, anticholinergics, antispasmodics, and  $\beta$ 3-agonists. We defined medical treatment as (1) two or more outpatient prescriptions or (2) a prescription for more than 30 days. Surgery for BPH consisted of TURP, PVP, HoLEP, and simple prostatectomy.

### 2.3. Outcomes

The primary outcome was the proportion of medical and surgical treatment for BPH. It was evaluated each year between 2012 and 2018. It was also evaluated by age group (i.e.,  $\leq 40$ , 41–50, 51–60, and 61–70 years) and the type of medical institutions. Secondary outcomes included total BPH diagnosis rate in each year of the study period. BPH diagnosis rate by age group (i.e.,  $\leq 40$ , 41–50, 51–60, and 61–70 years) was also evaluated.

Types of medical institutions were divided into four categories: tertiary referral hospitals, general hospitals, hospitals, and clinics. The proportion of medical and surgical treatment for BPH according to the type of medical institution was also investigated.

## 3. Results

### 3.1. BPH diagnosis rate

A progressive overall increase in the rate of BPH from 9,202 per 100 000 men in 2012 to 11,610 per 100,000 men in 2018 was seen ([Fig. 1](#)). The number of patients who visited a hospital due to BPH (N40) exceeded 3.24 million in 2012. It had increased steadily since then, exceeding 3.7 million in 2018 ([Supplementary Table 2](#)). The proportion of BPH patients in the entire cohort increased steadily from 2012 to 2018 ([Supplementary Table 2](#)). The number of patients with BPH was increased steadily from 2012 to 2018 in all age groups ([Fig. 2](#)). The proportion of BPH patients in the entire cohort increased steadily from 2012 to 2018 only in men aged 61–70 years ([Supplementary Table 2](#)). The ratio of patients by age to all BPH patients showed an increase with increasing age group in all study periods ([Supplementary Table 2](#)).

### 3.2. Proportion of medical and surgical treatment for BPH

The proportion of surgical treatment was 1.2% in 2012, 1.0% in 2013, 1.0% in 2014, 0.9% in 2015, 0.8% in 2016, 0.7% in 2017, and 0.8% in 2018 ([Fig. 3](#) and [Supplementary Table 3](#)). A progressive overall decrease in surgical treatment was seen from 2012 to 2018. The rate of surgical treatment for BPH increased with the age group in all study periods ([Fig. 4](#) and [Supplementary Table 3](#)). In the age group, a progressive decrease in surgical treatment was seen only in 51–60 years and 61–70 years groups from 2012 to 2018 ([Supplementary Table 3](#)).

### 3.3. Proportion of medical and surgical treatment for BPH according to the type of medical institution

The type of medical institution was classified into four categories: tertiary referral hospitals, general hospitals, hospitals, and clinics. Among these four types of medical institutions, the rate of surgical treatment in tertiary referral hospitals was the highest during the study period, followed by that in general hospitals, hospitals, and clinics ([Fig. 5](#)).

## 4. Discussion

The present study provided a long-term look at trends of medical and surgical management for patients with BPH using population-based data from South Korea. We found a steady increase in the diagnosis rate of BPH during the study period. In addition, the older age group accounted for a higher proportion of all BPH patients. From 2012 to 2018, surgical treatment gradually declined. We reported that a progressive overall decrease in surgical treatment from 2012 to 2018. However, the portion of surgical treatment for BPH increased with increasing age during the study

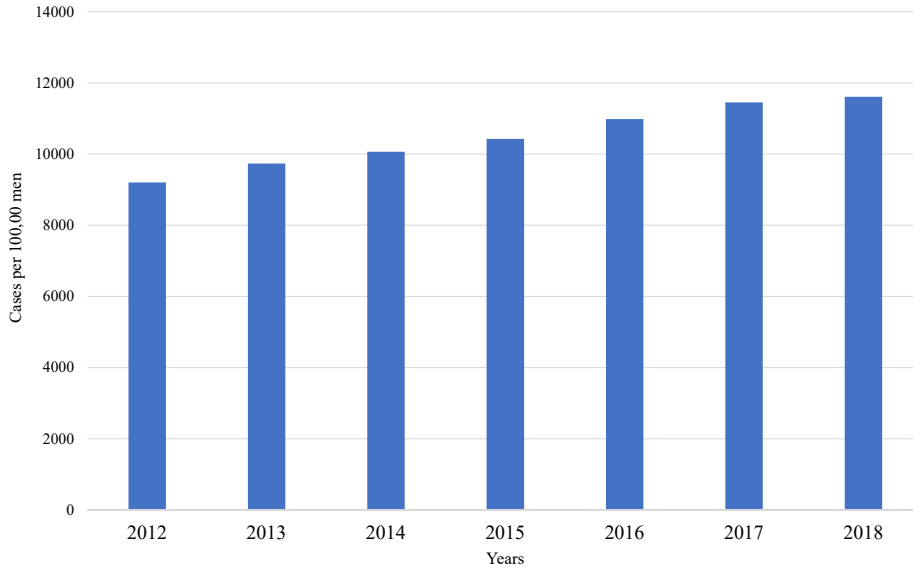


Fig. 1. Cases of BPH per 100,000 men during 2012–2018. BPH, benign prostatic hyperplasia.

period. During the study period, tertiary referral hospitals had the highest surgical treatment rate, followed by general hospitals, hospitals, and clinics.

The prevalence of BPH has been reported to increase significantly with increasing age.<sup>14</sup> In Western reports, 40–70% of men aged >60 years develop symptoms of prostatic hyperplasia.<sup>15,16</sup> Berry et al. have reported that histological prevalence rates of BPH in age groups of 40s, 50s, and 90s are 8%, 50%, and 80%, respectively, based on an autopsy study.<sup>15</sup> Go et al. have also reported that prevalence rates of BPH in age groups of 40s, 50s, 60s, 70s, and 80s or above are 8.9%, 16.8%, 25.0%, 26.7%, and 30.4%, respectively.<sup>17</sup> Korea is rapidly becoming an aging society; this may reflect the change of pattern for the diagnosis of BPH.<sup>18</sup> Therefore, the diagnosis of BPH decreased in the population aged <50 years. Observational studies in Europe, the United States, and Asia have also shown that older age is a risk factor for onset and progression of BPH.<sup>19–21</sup> Previous studies have

reported that the prevalence rate of BPH increases with increasing age,<sup>15,17</sup> consistent with the results of the present study. These results indicate that aging trend of the population in South Korea is accelerating and that the number of patients visiting hospitals with symptoms of urination because of BPH is also increasing rapidly. Therefore, it is essential to determine the prevalence of BPH in the entire population as well as the pathophysiology of BPH for establishing an effective treatment strategy.

The present study revealed a gradual decline in overall surgical treatment compared with drug treatment from 2012 to 2018. Many studies have reported the change of trend of BPH treatment. Welliver et al. have reported that medication use is increased, whereas surgery use is decreased during the study period from 2004 to 2013 in the United States.<sup>22</sup> Other previous studies analyzing the Medicare database also reported decreasing cases of surgery over time, although these studies did not include men

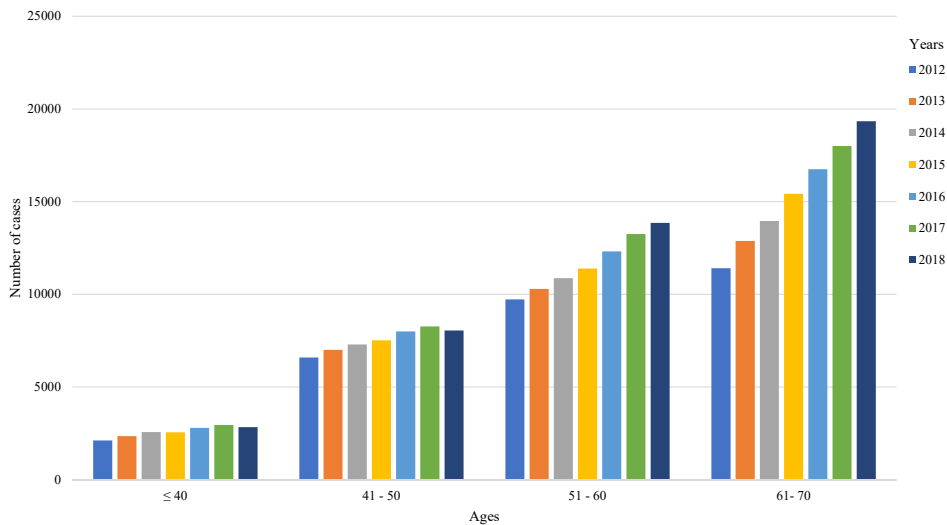


Fig. 2. Number of BPH patients during 2012–2018 according to age group. BPH, benign prostatic hyperplasia.

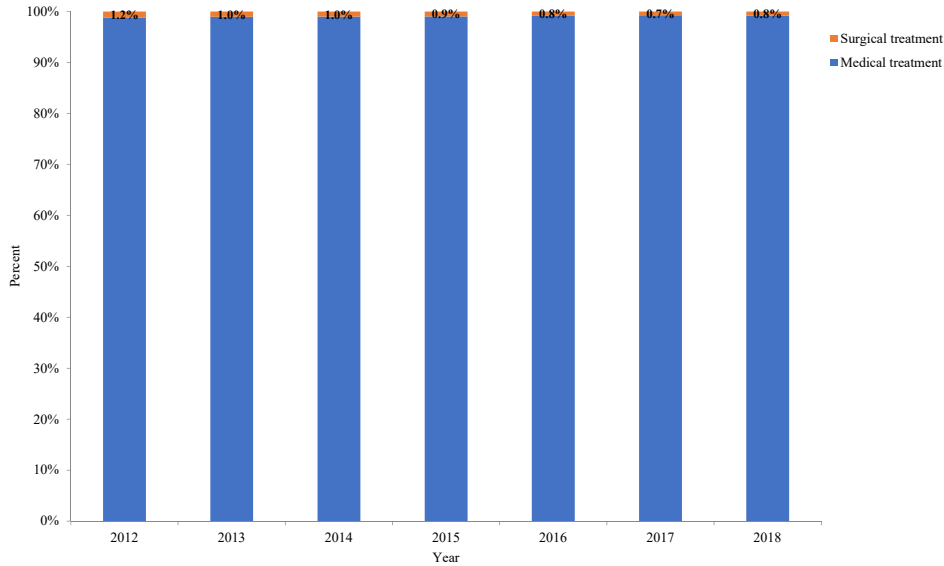


Fig. 3. Trends of medical and surgical treatment for BPH over time. BPH, benign prostatic hyperplasia.

younger than 65 years.<sup>8,23,24</sup> The increase in medical therapy and the overall decrease in surgical procedures with time are commensurate with the findings of the present study. Lower urinary tract symptoms related to BPH can be managed through behavioral, pharmacological, and surgical treatments based on symptom severity, patient goals, and physician preferences.<sup>25</sup> The trend in the medical and surgical management of patients with BPH is changing because of several factors. Surgical management of BPH has seen a sharp decline since the introduction of ABs to the market.<sup>7</sup> Prescribing BPH medications has become common over time.<sup>26</sup> Filson et al. found that the use of BPH medication increased from 14% in 1993–1995 to nearly 40% in 2008–2010.<sup>26</sup> Our study revealed an increase in drug treatment and an overall decrease in surgical procedures over time, consistent with results of previous studies. The present study also found that tertiary referral hospitals had the highest rate of surgical treatment, followed by general hospitals, hospitals, and clinics. This result might be associated with medical personnel and equipment available depending on the type of medical institution. It may also indicate that patients are willing to undergo surgeries in a larger medical institution.

The present study has several strengths. For the first time, we analyzed the changing proportion of medical and surgical management of BPH using Korean population data and found that surgical treatment decreased while medical treatment increased in Korea. Our findings will be of great help in understanding changes in the trend of BPH treatment for establishing a treatment strategy. Nevertheless, our study had several limitations. First, it is necessary to interpret our results in the context of certain limitations using administrative claims data set. In addition, we only used 3% of the national patient sample of the HIRA database. However, the 3% sample cohort of the HIRA database can fully reflect the treatment trend in South Korea. Kim et al.<sup>27</sup> explained the method and process of extracting sample data. They confirmed the reliability and validity of the sample data. Therefore, the sample data in the present study could sufficiently represent the treatment trend in South Korea. In addition, factors influencing the choice of treatment for BPH can be complex and pluralistic. Changes in surgical indication, the preference of the urologist, the patient's financial condition, demographic factors (rural vs. major cities), and clinical setting (inpatient vs outpatient) all could affect treatment choice.<sup>8,28</sup>

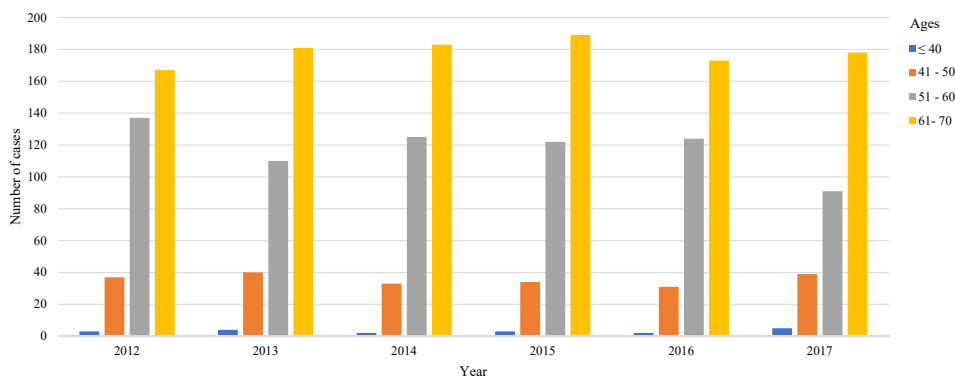


Fig. 4. Trends of surgical treatment for BPH by age group over time. BPH, benign prostatic hyperplasia.

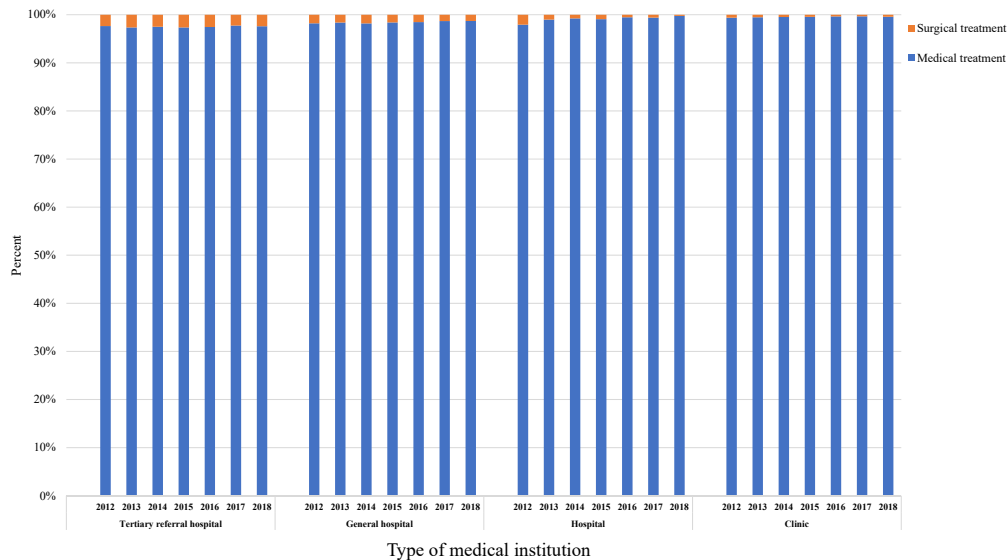


Fig. 5. Trends of surgical treatment for BPH by the type of medical institution over time. BPH, benign prostatic hyperplasia.

Unfortunately, the effects of these factors could not be investigated in this study because of limitations of administrative claims data set.

In conclusion, the present study comprehensively analyzed trends of national BPH management in Korea. In Korea, the diagnosis rate of BPH was steadily increasing during the study period. There was a difference in the proportion of BPH patients by age group. From 2012 to 2018, overall surgical treatment gradually decreased, whereas medical treatment increased among all treatments for BPH. A comprehensive treatment plan for BPH should be established considering this trend. However, because of the nature of claim data, the present study could not reflect several factors influencing the treatment trend of BPH. Therefore, a further study is needed to investigate the effects of these factors on the treatment of BPH.

### Conflicts of interest

The authors declare that no conflicts of interest in relation to this work.

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### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pnrl.2021.08.002>.

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