Technical Appendix

Data linkage

Questionnaire data from study participants have been linked probabilistically to hospitalisations and deaths by the Centre for Health Record linkage (http://www.cherel.org.au/). Hospitalisations were ascertained from the NSW Admitted Patient Data Collection (APDC), which is a complete census of all public and private hospital admissions in NSW. The linked data contain details of admissions in participants from 1 July 2000 to 30 June 2014, including dates of admission and discharge, the primary reason for admission up to 51 clinical diagnoses using the International Classification of Diseases 10th revision—Australian Modification (ICD-10-AM)(1), and up to 50 procedures codes, coded using the Australian Classification of Health Interventions.(2) Dates of death were ascertained from the date of recruitment up to 18 June 2014 using linkage to the NSW Register of Births, Deaths and Marriages (RBDM). Death registrations capture all deaths in NSW.

Baseline questionnaire measures

To measure LUTS, we used the modified International Prostate Symptom Score (m-IPSS). The m-IPSS used in the 45 and Up Study has been calibrated with IPSS results from a representative Australian study of male urinary symptoms.(3) The IPSS captures the following seven urinary symptoms by enquiring about men's self-reported urinary function and symptoms over the past month (4):

1) the sensation of not emptying the bladder after urination ('incomplete emptying')

2) having to urinate less than every two hours ('frequency')

3) stopping and starting again several times during urination ('intermittency')

4) difficulty postponing urination ('urgency')

5) a weak urinary stream (‘weak stream’)

6) having to strain to start urination (‘straining’)

7) having to get up at night to urinate frequently (‘nocturia’)

The modified version of IPSS used in the 45 and Up Study (m-IPSS) had identical questions regarding symptoms to the IPSS, but had a 4-point response scale (‘‘not at all’’, ‘‘sometimes’’, ‘‘often’’, ‘‘almost always’’) compared with a 6-point response scale used on the original IPSS. For the nocturia item, respondents were asked ‘over the past month, how many times did you usually get up from bed to urinate during the night?’. The m-IPSS was categorised as 0–5 (no/mild symptoms), 6–11 (moderate symptoms) and 12–21 (severe symptoms). We further divided the first two categories to form five categories of LUTS scores: 0-2, 3-5, 6-8, 9-11, and 12-21.

Sociodemographic factors included age, education attainment (no school certificate, certificate/diploma/trade, tertiary), region of birth (Australia/New Zealand, other countries), annual household income (<$20,000, $20,000-$39,999, $40,000-$69,999, $70,000 or more), private health insurance (yes/no), and region of residence (major cities, inner regional, and outer regional/remote/very remote). Health behaviours included smoking (never, past, and current), weekly alcohol consumption (0, 1-14 and ≥15 drinks), and tertiles of physical activity (<7, 7–12 and 13 or more weekly sessions, weighted for intensity).

Health conditions were determined using the question: ‘Has a doctor EVER told you that you have…’ ‘prostate cancer’, ‘heart disease’, ‘stroke’, ‘diabetes,’ ‘high blood pressure’ or ‘blood clot (thrombosis).’ Individuals were also asked ‘have you ever had any of the following operations?’ ‘vasectomy’, ‘part of prostate removed’, and ‘whole prostate removed.’ Erectile dysfunction was classified based on participants’ answer to the question ‘how often are you able to get and keep an erection that is firm enough for satisfactory sexual activity?’.

Study exclusions

The following participants were not included in the study:

(1) Those with a history of whole/part prostatectomy according to a self-report on the baseline questionnaire or a hospital admission in the 6 years prior to entering the study with any of the procedure codes listed in Supplementary Table 2 (n=12,309; 9.94%), and

(2) Those with self-reported prostate cancer on the baseline questionnaire or a hospital admission in the 6 years prior to entering the study with any of the cancer diagnosis codes listed in Supplementary Table 3 (n=4742; 3.83%).

References

1. National Centre for Classification in Health. International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM). Fifth edition. Sydney: National Centre for Classification in Health; 2006.
2. National Casemix and Classification Centre. The Australian Classification of Health Interventions (ACHI), Eighth edition, Tabular list of interventions. Sydney2013.
3. Latz I, Weber M, Korda R, Smith D, Clements M, Patel M, et al. Lower urinary tract symptoms in relation to region of birth in 95,393 men living in Australia: the 45 and Up Study. World journal of urology. 2013 Jun;31(3):673-82. PubMed PMID: 22940773.
4. Barry MJ, Fowler FJ, Jr., O'Leary MP, Bruskewitz RC, Holtgrewe HL, Mebust WK, et al. The American Urological Association symptom index for benign prostatic hyperplasia. The Measurement Committee of the American Urological Association. Journal of Urology. 1992 Nov;148(5):1549-57; discussion 64. PubMed PMID: 1279218.

Supplementary Table 1. Sensitivity analysis for Model 3, additionally adjusted for annual household income and private health insurance

	Events	Person-years	Rate	HR (95% CI)
Annual household income*				
<$20,000	744	101,472	4.53	1.00
$20,000-$39,999	759	106,734	4.61	1.06 (0.96-1.18)
$40,000-$69,999	590	125,971	4.44	1.03 (0.91-1.16)
$70,000 or more	674	192,632	5.06	1.19 (1.05-1.34)
Private health insurance**				
No	1094	211,445	3.99	1.00
Yes (Hospital/DVA)	2322	410,408	4.87	1.24 (1.14-1.34)

*Model 3 (adjusted for age alcohol consumption, smoking, BMI, region of birth, region of birth and LUTS score) was additionally adjusted for annual household income.

**Model 3 (adjusted for age alcohol consumption, smoking, BMI, region of birth, region of birth and LUTS score) was additionally adjusted for private health insurance.

Supplementary Table 2. Procedure codes to identify whole/part of prostate removed

1162 Destruction of tissue of prostate

37224-00 endoscopic destruction of lesion of prostate

90408-00 Other destruction of lesion of prostate

37224-01 Endoscopic resection of lesion of prostate

1165 Transurethral prostatectomy

37203−00 Transurethral resection of prostate

37201−00 Transurethral needle ablation of prostate

37203−02 Transurethral electrical vaporisation of prostate

1166 Other closed prostatectomy

37207−00 Endoscopic laser ablation of prostate

37207−01 Endoscopic laser excision of prostate

37203−03 Cryoablation of prostate

37203-04 Microwave thermotherapy of prostate

37209−01 Laparoscopic radical prostatectomy

37210−01 Laparoscopic radical prostatectomy with bladder neck reconstruction

37211−01 Laparoscopic radical prostatectomy with bladder neck reconstruction and pelvic lymphadenectomy

37203−06 Other closed prostatectomy

1167 Open prostatectomy

37200−03 Suprapubic prostatectomy

37200−04 Retropubic prostatectomy

37209−00 Radical prostatectomy

37210−00 Radical prostatectomy with bladder neck reconstruction

37211−00 Radical prostatectomy with bladder neck reconstruction and pelvic lymphadenectomy

37200−05 Other open prostatectomy

Supplementary Table 3. Diagnosis codes to identify cancer

C60	Penis
C61	Prostate
C63	Other male genital organs
C67	Bladder
C65, C66, C68	Other urinary organs
C18	Colon
C19-C20	Rectum