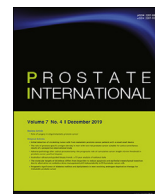




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Research Article

Australian ultrasound-guided biopsy trends: a 17-year analysis of national data

Lachlan A.N. Gordon^{a, b, *}, Jonathan Kam^{a, c, d}, Daniel Gilbourd^a, Hodo Haxhimolla^{a, e}^a Department of Urology, The Canberra Hospital, ACT, Australia^b University of Queensland School of Medicine, Australia^c University of Newcastle School of Medicine, Australia^d University of Sydney School of Medicine, Australia^e Australian National University School of Medicine, Australia

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SUMMARY

Background: Prostate cancer diagnosis is primarily performed through ultrasound-guided biopsy. Australia has a Stage 4 aging population and as prostate cancer is a disease of middle aged to elderly patients, it would be expected that there would be an increase in the diagnosis of prostate cancer. However, several key events have occurred in the last 10 years including the introduction of multi-parametric magnetic resonance imaging (mpMRI) of the prostate and publication of major prostate cancer screening trials and guidelines. We aimed to characterize the trends in prostate biopsy in Australia in the context of these changes.

Methods: Population and prostate biopsy data were obtained from the Australian Government Bureau of Statistics Census data and the Australian Department of Health Medicare Benefits Schedule between 2000 and 2017. A meta narrative review of publications, guidelines, and policy announcements regarding prostate cancer screening and diagnosis in Australia was performed. Prostate biopsy trends were analyzed from 2000 to 2017 by age-group and year.

Results: The 2016 Census data showed the male population of Australia was 11,546,638. Between 2000 and 2017, a total of 373,158 ultrasound-guided biopsies were performed in Australia. A general decline in the total number of prostate biopsies performed was observed from 2009 onwards. There was a transition of the highest prostate biopsy age-group from 55–64 to 65–74 years with the transition occurring in 2012. Biopsy numbers in the age-group 75–84 years also slowly increased from 2000 to 2009 and declined for a short period of time till 2013 and is on the rise again.

The decrease in 2010 coincides with the increased uptake of mpMRI in Australia as a new tool in the screening for prostate cancer. Furthermore, this decrease also coincides with the release of the European Randomized Study of Screening for Prostate Cancer (ERSPC) and the Prostate, Lung, Colorectal and Ovarian Cancer Screening Trial (PLCO) prostate cancer screening trials in 2009 and the policy statements developed as a result of these by Royal Australian College of General Practitioners and Urological Society of Australia and New Zealand.

Conclusion: Interesting trends have been identified through this population study. With an aging population, it would be expected that the number of prostate biopsies would be increasing. It is likely that the introduction of mpMRI in Australia and the release of prostate cancer screening guidelines have decreased the number of patients being screened for prostate cancer. Furthermore, increasing use of active surveillance may be responsible for the increase in the prostate biopsies occurring in the older age-groups.

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1. Introduction

Prostate cancer is the second most common cancer diagnosed in men worldwide and the fourth of all malignancies diagnosed. In

* Corresponding author. Department of Urology, The Canberra Hospital, ACT, Australia.

E-mail address: lachlan.gordon@gmail.com (L.A.N. Gordon).

fact, it contributes to 7.9% of all global malignancies in accordance with the World Health Organization¹. The early detection and treatment of prostate cancer could impact significantly on progression of the disease and thus impact on the expenditure on medical treatments.² Prostate cancer is more commonly detected in men older than 60 years of age and the earlier detection and treatment³ of this could aid in a country's national expenditure on health care.⁴ This is particularly pertinent in the setting of Australia's Stage 4 aging population.(See Table 1)

Diagnosis of prostate cancer in Australia is primarily performed through ultrasound-guided biopsy. This is through either transrectal or transperineal approaches. Globally prostate cancer incidence rates vary by more than 25-fold with Australia and New Zealand among the highest rates.⁵ This is likely secondary to access to health-care services through public health programs. It is also estimated that 1.3 million new cases of prostate cancer will be diagnosed in 2018.⁵

Australia has a well-established public health program, Medicare, which allows for billing and data collation of the number of procedures within their country. Because of this, we aimed to characterize the ultrasound-guided biopsy trends within this country by using this data from the Australian Government Medicare Benefits Schedule online database.

2. Method

A population study was performed as part of a project with ethics approval (ACT/HREC/ETHLR18.075).

Prostate biopsy numbers were obtained from the Australian Government Department of Health Medicare Benefits Schedule using the item numbers which code for ultrasound-guided prostate biopsy. Population data were obtained from the Australian

Government Bureau of Statistics Census. Data were analyzed using Microsoft Excel.

A meta narrative review of the literature following the RAMSES guidelines⁶ was performed to correlate trends within Australia for the introduction of new technologies for the detection of prostate cancer and policies and procedures from the major governing medical colleges in relation to prostate cancer. We also performed a review of the literature and policy announcements in Australia to assess the impact these may have had on the total number of prostatectomies performed. A literature search was performed through medical databases MEDLINE and EMBASE regarding key literature focused on the Australian guidelines in relation to prostate cancer surveillance and diagnosis. A thorough search of Australian medical colleges and government organizations was also carried out to complete the narrative review to ensure that no Australian policies or guidelines were excluded from the analysis. These were then graphically linked to the prostate biopsy trends in Australia.

3. Results

The 2016 census data showed the male population of Australia as 11,546,638, with 3,045,845 men aged 55 years and older in 2016; 18,285 ultrasound-guided biopsies were performed, with 16,586 being performed in men older than 55 years, resulting in a biopsy rate of 0.54%⁷.

Between 2000 and 2017, a total of 373,158 ultrasound-guided biopsies were performed in Australia. Ultrasound-guided biopsies in Australia increased at a linear rate of approximately 2000 to 3000 biopsies per year until 2009 (Figs. 1 and 2). The number of biopsies per year performed peaked at 29,818 in 2009. Since then Australia showed a decline in the total number of biopsies performed from 2009. The decrease in the number of biopsies

Table 1
Total prostate biopsies by age-group in Australia from 2000 to 2017.

Year	0-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75-84	>85
2000	0	0	2	9	53	1148	4084	4420	1019	107
2001	1	0	5	9	76	1354	4521	4733	1159	121
2002	0	0	3	12	78	1449	4880	4907	1190	124
2003	0	1	3	9	86	1496	6055	5754	1503	122
2004	1	1	2	10	134	1974	7540	7194	1823	116
2005	0	1	4	12	126	2197	8213	7077	2116	137
2006	0	0	5	18	170	2454	8943	7545	2295	120
2007	0	0	4	10	206	2875	10041	8700	2654	155
2008	0	0	9	22	218	3056	10647	9176	2854	164
2009	1	0	3	17	311	3630	12061	10500	3122	173
2010	0	0	1	14	301	3377	10743	9144	2537	163
2011	1	0	4	16	339	3301	10625	9554	2681	190
2012	0	1	7	18	281	3192	10259	9858	2670	222
2013	1	0	3	17	271	2746	9029	9321	2411	195
2014	0	0	1	17	208	2062	7239	8539	2576	265
2015	0	0	3	8	155	1772	6727	8184	2695	264
2016	0	0	5	6	127	1561	6011	7713	2613	249
2017	0	0	1	3	148	1519	6112	8408	2851	293

Australian Total US Guided Prostate Biopsies

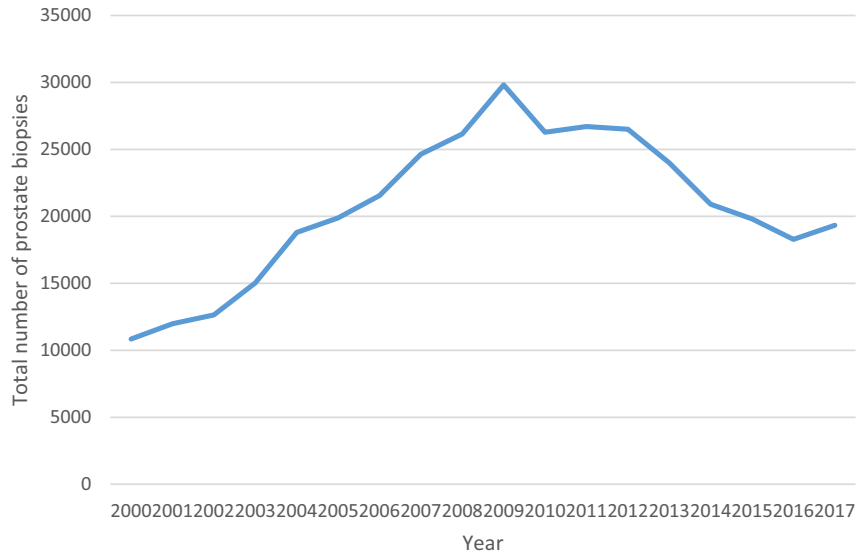


Figure 1. Australian total US-guided prostate biopsies. US, ultrasound.

performed generally followed a linear rate and this varied from approximately 1000–2500 biopsies per year until 2016. There was a plateau from 2010 to 2012 with the total number of biopsies between 26,280 and 26,711 each year. In 2017, we noticed a rise in the number of biopsies by 5.74% (n = 1050) from the previous year (Figs. 3 and 4).

Over the course of the 17 years, the age-group of 55–64 years was the group with the highest biopsy numbers (n = 143,730). In 2013, this transitioned to the age-group between 65 and 74 years. Biopsy numbers in the age-group 75–84 years also slowly

increased from 2000 to 2009 and declined in 2010 and continued to slowly rise until 2017.

4. Discussion

Identification and characterization of prostate cancer to ensure treatment of clinically significant disease, minimization of over-treatment and minimization of biopsy related complications is a significant challenge.

Australian US Guided Prostate Biopsies

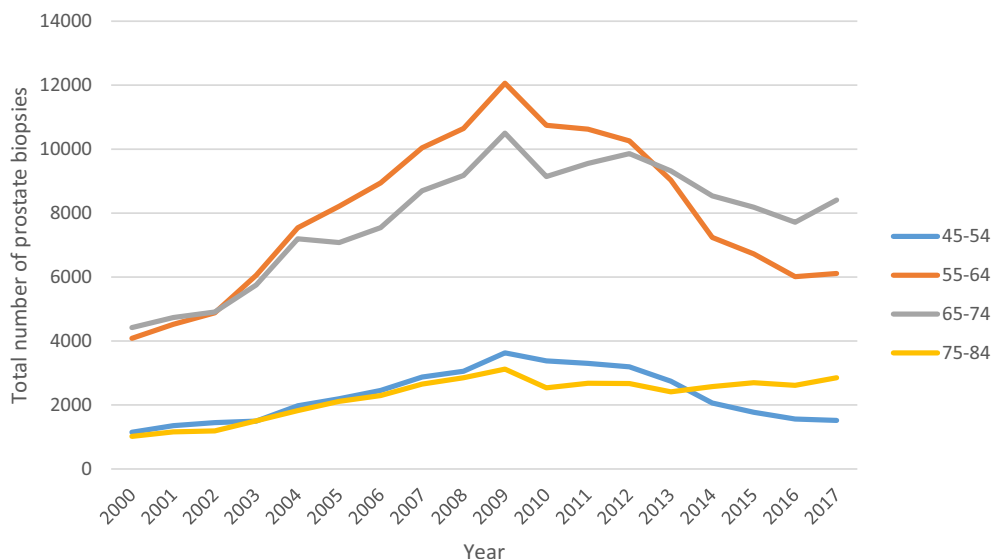


Figure 2. Australian US-guided prostate biopsies by age-group. US, ultrasound.

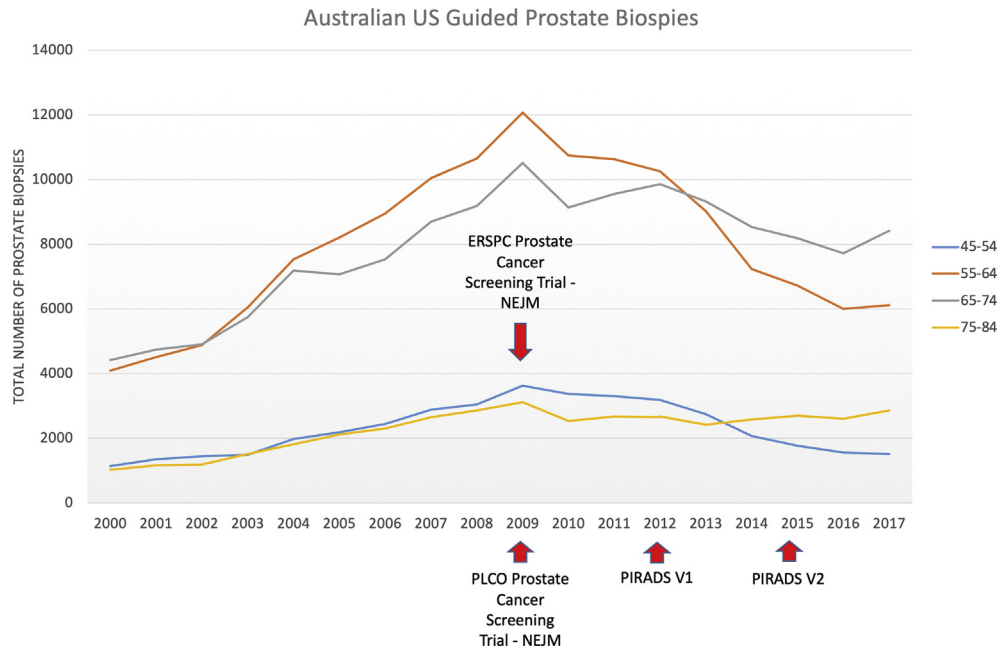


Figure 3. Key screening studies labeled.

Following review of this data, we noticed important trends in ultrasound-guided prostate biopsies throughout the country. The most notable of which was the decline in the number of ultrasound-guided biopsies performed since 2009. This decrease in the number of biopsies performed was demonstrated in all age-groups at least immediately after 2009 with the >75 years age-group continuing to increase after this initial drop. Interestingly, it was also noted that the highest age-group biopsied transitioned in 2013 from 55–64 to 65–74 years. This could potentially be reflected in the process of

active surveillance as repeat biopsy is unable to be differentiated from this data.

In March 2009, the New England Journal of Medicine published both the Screening and prostate cancer mortality in a randomized European Study (ERSPC)⁸ and mortality results from a randomized prostate cancer screening trial (PLCO)⁹. The ERSPC trial came to the conclusion that prostate cancer screening reduced the rate of death from prostate cancer by 20% but was associated with a high risk of over diagnosis. The PLCO trial concluded that the rate of death from prostate cancer was very low and did not differ significantly

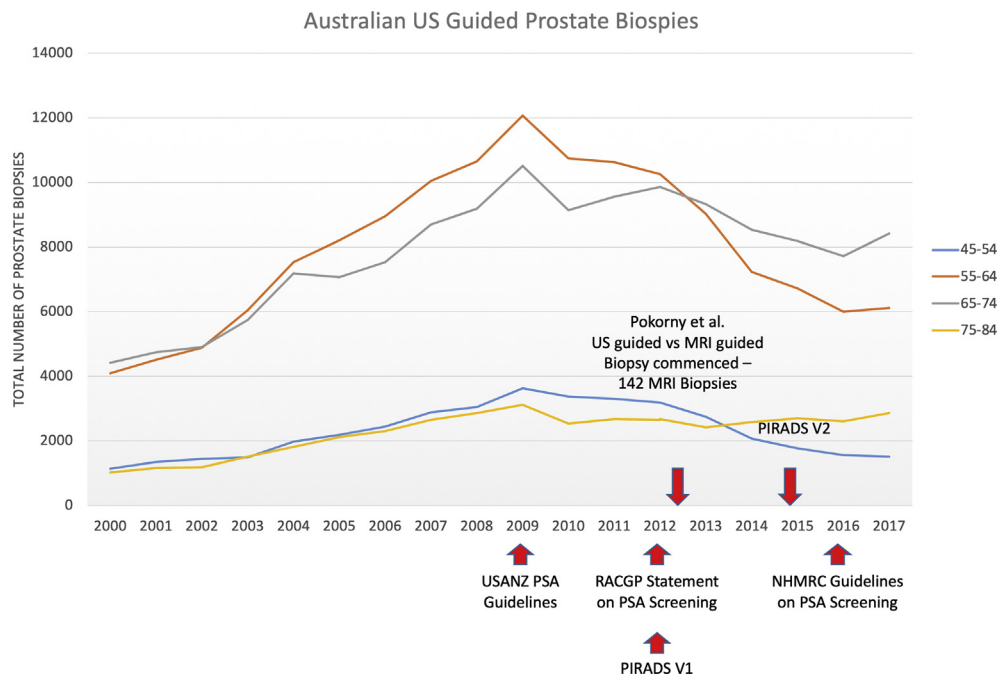


Figure 4. Key Australian guidelines and policy statements.

between the screening group and the control group. Because of these studies, both the Royal College of General Practitioners (RACGP) and the Urological Society of Australia and New Zealand (USANZ), a member of the Royal Australasian College of Surgeons released guidelines regarding PSA testing.

RACGP released their 'Red Book'¹⁰ in 2009 which established guidelines for preventative activities in general practice. In relation to PSA and prostate cancer, their guidelines stated that 'both Digital Rectal Examination (DRE) and Prostate Specific Antigen (PSA) is not recommended and that general practitioners should not raise the issue with men unless asked about it referring men to the book 'Let sleeping dogs lie'^{11,10}. We postulate that this may have had a significant impact on the way men were screened for prostate cancer from the front line. In Australia access to urological services is only possible after general practitioner's referral.

Despite these guidelines from RACGP, USANZ released their statement and guidelines in 2009 as well. The 'USANZ PSA Testing Policy' (2009)¹² recommended testing for men older than the age of 40 years if concerned about their prostate health. The specific statement was that 'men interested in their prostate health in these younger age-groups could have a single PSA test and DRE performed at or beyond age of 40 years to provide an estimate of their prostate cancer risk over the next 10–20 years based on age-specific median PSA values, with the intensity of subsequent monitoring.'¹² There has also been growing concern from the urology community in relation to the lack of PSA screening being performed.

In July 2012, the US Preventive Services Task Force released a statement on prostate cancer screening stating against the use of PSA-based screening for prostate cancer regardless of age.¹³ This reflects the similar stance of RACGP in relation to the results and recommendations from the PLCO trial.

In Australia, multiparametric magnetic resonance imaging (mpMRI) of the prostate is commonly used by urologists and we hypothesized that this may have been the cause for lower rates of ultrasound-guided prostate biopsy. We noted in 2012, Prostate Imaging Reporting and Data System (PI-RADS) version 1¹⁴ was released and this could have had further impact on the biopsies decline until 2016. We hypothesize that this is because of the decrease in biopsies being performed on men with a PI-RADS score <3 as their risk of clinically significant prostate cancer is low. They have also released PI-RADS version 2¹⁵ in 2016 and further analysis of trends will be required to assess the potential impact that this could have on future ultrasound-guided biopsies.

Another influence on the diagnosis of prostate cancer in Australia was in 2014 when Pokorny et al.¹⁶ published an ultrasound- vs MRI-guided biopsy study MRI-targeted biopsies with cognitive or technical modalities have likely reduced the need for multiple biopsies in many patients.

In addition, Thompson et al.¹⁷ published in 2014 a prospective study that assessed mpMRI-guided biopsies to detect clinically significant prostate cancer. They showed that mpMRI reported by expert radiologists achieved a negative predictive value of 100% (confidence interval CI 82–100), 94% (CI 81–93) and 74% (CI 61–83) in PI-RADS 1, 2, and 3 respectively.¹⁷ This is likely to have affected prostate cancer biopsy trends in as patients with a mpMRI PI-RADS score ≤3 may be unlikely to undergo biopsy. This led to the introduction of mpMRI Medicare rebate for prostate cancer screening in 2018.

The National Health and Medical Research Council approved the Prostate Cancer Foundation of Australia guidelines on PSA screening in 2016.¹⁸ The general recommendation is that for those between the age of 50–69 years who decide to have PSA testing should undergo a blood test every 2 years.¹⁸ These guidelines have

been endorsed by RACGP and USANZ as well as other key stakeholder colleges throughout Australia.

More recently in May 2018, the US Preventive Services Task Force produced their 'Final Recommendation Statement' on prostate cancer screening.¹⁹ This reflects the National Health and Medical Research Council guideline in that men aged 55–69 years should be fully informed of the risks and benefits of PSA-based screening before deciding whether to be screened or not.¹⁹ These guidelines follow the USANZ guidelines more closely and we will have to wait to see if this has an impact on the number of ultrasound-guided biopsies in the future.

Unfortunately, we cannot extrapolate repeat biopsy from this data set and this could be the cause of age migration through active surveillance. This could potentially explain the age migration shift in 2013. The data set does not include whether or not the episode was the primary biopsy or a repeat biopsy. Patients before the introduction of mpMRI with a persistently raised PSA may have had multiple biopsies to ensure that clinically significant cancer was not missed. This could reflect the elevated numbers before 2009. With the introduction of mpMRI, for patients with a PI-RADS score ≤3 urologists may be more confident in avoiding repeat biopsy or even primary biopsy in patients with a raised PSA. More recently in June 2019, the 'NICE Guidance – Prostate cancer: diagnosis and management' was published with the recommendation that mpMRI should be offered as the first-line investigation for people with suspected clinically localized prostate cancer.²⁰

5. Conclusion

Interesting trends have been identified through this population study. Recognizable decreases in the number of biopsies performed since 2009–2010 are likely attributable to the introduction of PSA screening guidelines by both RACGP and USANZ. It also coincides with the release of the ERSPC and PLCO prostate cancer screening trials in 2009. It was also theorized that the introduction of mpMRI in Australia as a new tool used for the screening of prostate cancer may have also had an impact in the decreasing rates of ultrasound-guided prostate biopsy. With the introduction of government rebates for mpMRI as well as the National Institute for Health and Care Excellence (NICE) guidelines recommendations, it is envisaged that prostate biopsy numbers will continue to decrease with increasing availability of mpMRI.

Conflict of interest

The authors have no conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.prn.2019.09.002>.

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