



Original Article

Organisation of Prostate Cancer Services in the English National Health Service



A. Aggarwal^{*†}, J. Nossiter[‡], P. Cathcart^{†‡}, J. van der Meulen^{*†}, J. Rashbass[§], N. Clarke[¶], H. Payne^{||}

^{*} Department of Health Services Research and Policy, London School of Hygiene and Tropical Medicine, London, UK

[†] National Prostate Cancer Audit, Royal College of Surgeons of England, London, UK

[‡] Centre for Experimental Cancer Medicine, Bart's Cancer Institute, Queen Mary University of London, London, UK

[§] National Cancer Registration Service, Public Health England, UK

[¶] Christie and Salford Royal NHS Foundation Trusts, Manchester, UK

^{||} University College London Hospitals NHS Foundation Trust, London, UK

Received 24 November 2015; received in revised form 18 January 2016; accepted 19 January 2016

Abstract

Aims: The National Prostate Cancer Audit (NPCA) started in April 2013 with the aim of assessing the process of care and its outcomes in men diagnosed with prostate cancer in England and Wales. One of the key aims of the audit was to assess the configuration and availability of specialist prostate cancer services in England.

Materials and methods: In 2014, the NPCA undertook an organisational survey of all 143 acute National Health Service (NHS) Trusts and 48 specialist multi-disciplinary team (MDT) hubs across England. Questionnaires established the availability and location of core diagnostic, treatment and patient-centred support services for the management of non-metastatic prostate cancer in addition to specific diagnostic and treatment procedures that reflect the continuing evolution of prostate cancer management, such as high-intensity focused ultrasound (HIFU) and stereotactic body radiotherapy.

Results: The survey received a 100% response rate. The results showed considerable geographical variation with respect to the availability of core treatment modalities, the size of the target population and catchment areas served by specialist MDT hubs, as well as in the uptake of additional procedures and services. Specifically there are gaps in the availability of core radiotherapy procedures; high dose rate and low dose rate brachytherapy are available in 44% and 75% of specialist MDTs, respectively. By comparison, there seems to be a relative 'over-penetration' of surgical innovation, with 67% of specialist MDTs providing robotic-assisted laparoscopic prostatectomy and 21% HIFU. There is also evidence of increased centralisation of core surgical procedures and regional inequity in the availability of surgical innovation across England.

Conclusions: The organisational survey of the NPCA has provided a comprehensive assessment of the structure and function of specialist MDTs in England and the availability of prostate cancer procedures and services. As part of the prospective audit, the NPCA will assess the effect of the availability of prostate cancer services on access regionally and subsequent outcomes of care according to evidence-based guidelines.

© 2016 The Royal College of Radiologists. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Key words: Centralisation; clinical audit; geographical inequality; health services; prostate cancer

Introduction

Cancer services in the National Health Service (NHS) continue to be developed. In the 1990s, it was recognised that cancer services were fragmented and poorly organised

[1]. In response, complex curative treatment services were concentrated on fewer clinicians within hospitals and these were required to work together in multidisciplinary teams (MDTs). Also, a new geographical configuration was established, with local cancer units referring complex or rare cancer conditions to a regional specialist MDT [2,3].

A specialist prostate cancer MDT can be considered as a hub made up of one or more specialist centres coordinating services for the referring local cancer units. Many of the prostate cancer centres also provide services for other urological

Author for correspondence: A. Aggarwal, Department of Health Services Research and Policy, London School of Hygiene and Tropical Medicine, 15–17 Tavistock Place, London WC1H 9SH, UK. Tel: +44-207-9272135.

E-mail address: ajay.aggarwal@lshtm.ac.uk (A. Aggarwal).

malignancies, such as bladder and renal cancer. Through this set-up, all newly diagnosed patients should have access within their area to the full range of services required for comprehensive high-quality cancer management.

In 2014, the National Prostate Cancer Audit (NPCA) (www.npca.org.uk) [4,5] undertook an organisational survey of NHS cancer units and centres providing care for prostate cancer patients in England and Wales to describe the services they provide. The survey examined the pattern of regional coordination and assessed the availability of core diagnostic, treatment and patient-centred support services. It also looked at the availability of specific additional diagnostic and treatment procedures that reflect the continuing evolution of the management of patients with this condition. Here we present the survey results for England only. The results for Wales will be published separately.

Materials and Methods

Two questionnaires were developed by the NPCA for the organisational survey. The first questionnaire was directed at all NHS providers of prostate cancer care (including both local cancer units and cancer centres) in England with specific questions about the availability of diagnostic and therapeutic procedures and support services. The second questionnaire was only directed at specialist MDTs. This questionnaire aimed to obtain information about the regional coordination of curative treatment services and the availability of specialist expertise.

The prostate cancer lead for each provider was identified and the survey was delivered electronically. Non-responders were contacted by e-mail and telephone until a 100% response rate was achieved. During the analysis of the data, results were clarified with each prostate cancer lead when necessary. The results presented in this paper reflect the pattern of services as of December 2014, but the results for named providers, which are being updated periodically, can be found on the NPCA's website (www.npca.org.uk/reports).

For the purpose of this organisational survey, a prostate cancer centre was defined as an NHS unit that provides specialist curative (or radical) prostate cancer treatments (surgery and/or radiotherapy services). We assessed the availability of core procedures and services in diagnostic, treatment and patient-centred domains (Table 1). These core services were chosen as they are included in national and international guidelines for the management of non-metastatic prostate cancer [6–8].

Within the patient-centred domain, the provision of a joint specialist uro-oncology clinic was also included. This clinic enables patients who are considered to be candidates for radical treatment to meet both urologists and oncologists at the same clinic visit – either as a joint consultation or separate consultations – to discuss treatment options. It is a measure of service quality according to the English National Peer Review Programme for cancer services [3].

The survey also assessed the availability of specific additional procedures, including transperineal template

Table 1

List of core and additional procedures and services

Core diagnostic procedures:
• Magnetic resonance imaging
• Multiparametric magnetic resonance imaging
• Isotope bone scan
Additional diagnostic procedures
• Template biopsy
• Choline positron emission tomography
Core treatment procedures
• Radical prostatectomy (open or laparoscopic)
• External beam radiotherapy
• Intensity-modulated radiotherapy
• High dose rate brachytherapy
• Low dose rate brachytherapy
Additional treatment procedures
• Robotic-assisted laparoscopic prostatectomy
• High-intensity focused ultrasound
• Cryotherapy
• Stereotactic body irradiation
Patient-centred support services
• Sexual function services
• Continence services
• Counselling services
• Joint specialist uro-oncology clinic

biopsy, choline positron emission tomography imaging, robotic-assisted laparoscopic prostatectomy, high-intensity focused ultrasound (HIFU), cryotherapy and stereotactic body irradiation. These additional procedures are currently not considered to be part of standard practice according to most national and international guidelines, but there is growing evidence supporting their use for particular indications [9–15].

A colour coding system was developed to categorise specialist MDTs according to the availability of core procedures and services in the geographical area they cover [16]. This also accounted for services provided by external providers that, although outside of this area, provide selected specialist services to Trusts within the specialist MDT hub. Specialist MDTs that have all core procedures or services available within a particular domain were given a green colour, those not having one core procedure or service available an amber colour, and those not having two or more core procedures or services available a red colour. The availability of specific additional diagnostic and treatment services was graded green if at least one was available and red if none were available.

The specialist MDTs were subsequently ranked according to this colour coding system, with the highest weight assigned to the availability of core diagnostic procedures, followed by the availability of core treatment procedures and then followed by the availability of patient-centred services. Similar colour coding systems have been used for public reporting of national UK survey data [3,17,18]. Further ranking was based on the number of additional diagnostic and treatment procedures available.

At the time of the survey, the 30 English NHS cancer networks that were responsible for coordination and

commissioning of cancer services had been disbanded and replaced by 27 local area teams across England. The geographical boundaries of these area teams account for service patterns and local geographies within which clinical commissioning groups coordinate the delivery of services [19]. One or more prostate cancer specialist MDTs are located within each of the area teams. The availability of core treatment services within each local area teams was therefore analysed given that certain services should be centralised to serve a catchment population of 1–1.5 million people and therefore would not be expected to be provided by every specialist MDT, e.g. high dose rate brachytherapy. Survival analyses have been published by the Office of National Statistics according to NHS area teams [20]. Since April 2015 the area teams have been replaced by four regional teams across England (<https://www.england.nhs.uk/about/regional-area-teams/>).

Results

Configuration of Specialist Multidisciplinary Teams

All NHS providers of prostate cancer services in England participated in the organisational survey: 143 NHS Trusts and 48 specialist MDTs. There are, in total, 72 prostate cancer centres providing radical prostate cancer treatments: 43 provide both surgery and radiotherapy, 18 only surgery and 11 only radiotherapy. The configuration of specialist MDTs is complex and the geographical areas they serve vary in size. The median number of NHS Trusts linked to a specialist MDT is three, with a range from one to seven. Some NHS Trusts refer patients to more than one specialist MDT. This occurs in circumstances where patients live within the catchment area of two neighbouring specialist MDTs.

Typically, an area served by a specialist MDT includes one or two cancer centres providing surgery, radiotherapy or both. However, we found that there are two specialist MDTs without a cancer centre in their area that can deliver surgery and 1 specialist MDTs without a cancer centre that can deliver radiotherapy. These specialist MDTs instead refer patients to specialist MDTs in adjacent areas for surgical and radiotherapy procedures. In the results presented below, these referring specialist MDTs are still considered to provide these services through their established referral pathways for specialist services.

Availability of Core Prostate Cancer Services

Specialist MDTs ranked according to the availability of core procedures and services in diagnostic, treatment and patient-centred service domains are presented in Table 2. Only 10 of the 48 specialist MDTs (21%) have all core procedures and services available in their area (scoring 'green' on all three core domains), whereas for 12 specialist MDTs (25%) at least two core procedures or services are unavailable within one or more domains (scoring 'red' for at least one domain).

Forty-four specialist MDTs (92%) have all core diagnostic procedures available in their area. Multiparametric magnetic resonance imaging is not locally available in four specialist MDTs and isotope bone scanning is also not locally available in one of these four. Only 16 specialist MDTs (33%) have all core treatment procedures locally available. All 48 specialist MDTs provide radical prostatectomy, with 47 providing a laparoscopic approach (robot assisted or standard). All specialist MDTs provide external beam radiotherapy either through an NHS Trust within the specialist MDT or an external provider (11 specialist MDTs access external beam radiotherapy in this way). The availability of other core radiotherapy modalities varies: intensity-modulated radiotherapy is provided by 45 specialist MDTs (94%), low dose rate brachytherapy by 36 (75%) and high dose rate brachytherapy by 21 (44%).

Figure 1 shows the availability of high and low dose rate brachytherapy across the 27 NHS England local area teams. Seven local area teams provide only one brachytherapy modality and are coloured yellow. Four local area teams have no brachytherapy modalities available and are coloured red. It should be noted that in the North Yorkshire and Humber area team (coloured red), although no high or low dose rate brachytherapy is available onsite at any of the Trusts within the region, patients attending York and Harrogate NHS Trusts are able to access this routinely through Leeds University Hospitals NHS Trust, which is based in the West Yorkshire Area team.

Twenty-five specialist MDTs (52%) indicated that they offer a joint specialist uro-oncology clinic. Forty-seven specialist MDTs (98%) provide sexual function, continence and counselling services. Continence and counselling services are not provided locally in one specialist MDT.

Availability of Additional Diagnostic and Treatment Procedures

Thirty-four specialist MDTs (71%) provide template biopsy and 31 (65%) choline positron emission tomography, with 24 (58%) providing both additional diagnostic procedures. It is important to note that three specialist MDTs that do not provide multiparametric magnetic resonance imaging – a core diagnostic procedure – do provide at least one additional diagnostic procedure.

Thirty-two specialist MDTs (67%) have robotic-assisted laparoscopic prostatectomy available in their area, 10 (21%) HIFU, eight (16%) cryotherapy and five (10%) stereotactic body irradiation. No specialist MDT offers all four of these additional treatments locally, but five specialist MDTs offer three. Again, it is noteworthy that 26 of the 32 (81%) specialist MDTs that do not provide all core treatment procedures do provide at least one additional treatment procedure.

Discussion

Our survey shows that the organisation of specialist urological services in the English NHS is complex, with

Table 2

Colour coding of specialist multidisciplinary teams according to the procedures and services they deliver (see text for further details)

Specialist multidisciplinary team	Number of core procedures and services			Number of additional procedures	
Specialist multidisciplinary team lead unit	Traffic light core diagnostics	Traffic light for core treatments	Traffic light for patient-centred services	Additional diagnostic	Additional treatment
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					
47					
48					

evidence of considerable geographical variation. Typically, the specialist MDT hub is a hierarchical regional structure with one cancer centre providing specialist services to two or more local cancer units in their region serving a target population of about 1 million people, in keeping with national guidance [2,3]. However, we found that many different structures exist.

First, there is a move towards further centralisation, with currently two specialist MDTs referring to an external cancer centre linked to a neighbouring specialist MDT hub for radical prostatectomy and 11 specialist MDTs referring externally for radiotherapy modalities.

Second, there remain gaps in the availability of core radiotherapy procedures, such as high and low dose rate brachytherapy. Current guidelines recommend high dose rate brachytherapy as an adjunct to external beam radiotherapy for intermediate and high-risk prostate cancer patients [21,22]. However, we found that it is only provided by 44% of the specialist MDTs. Low dose rate brachytherapy is recommended for patients with low- and intermediate-risk prostate cancer [8,23,24] and it is only provided by 75% of the specialist MDTs.

Third, the target populations and catchment areas of specialist MDTs can vary considerably in size. For example,

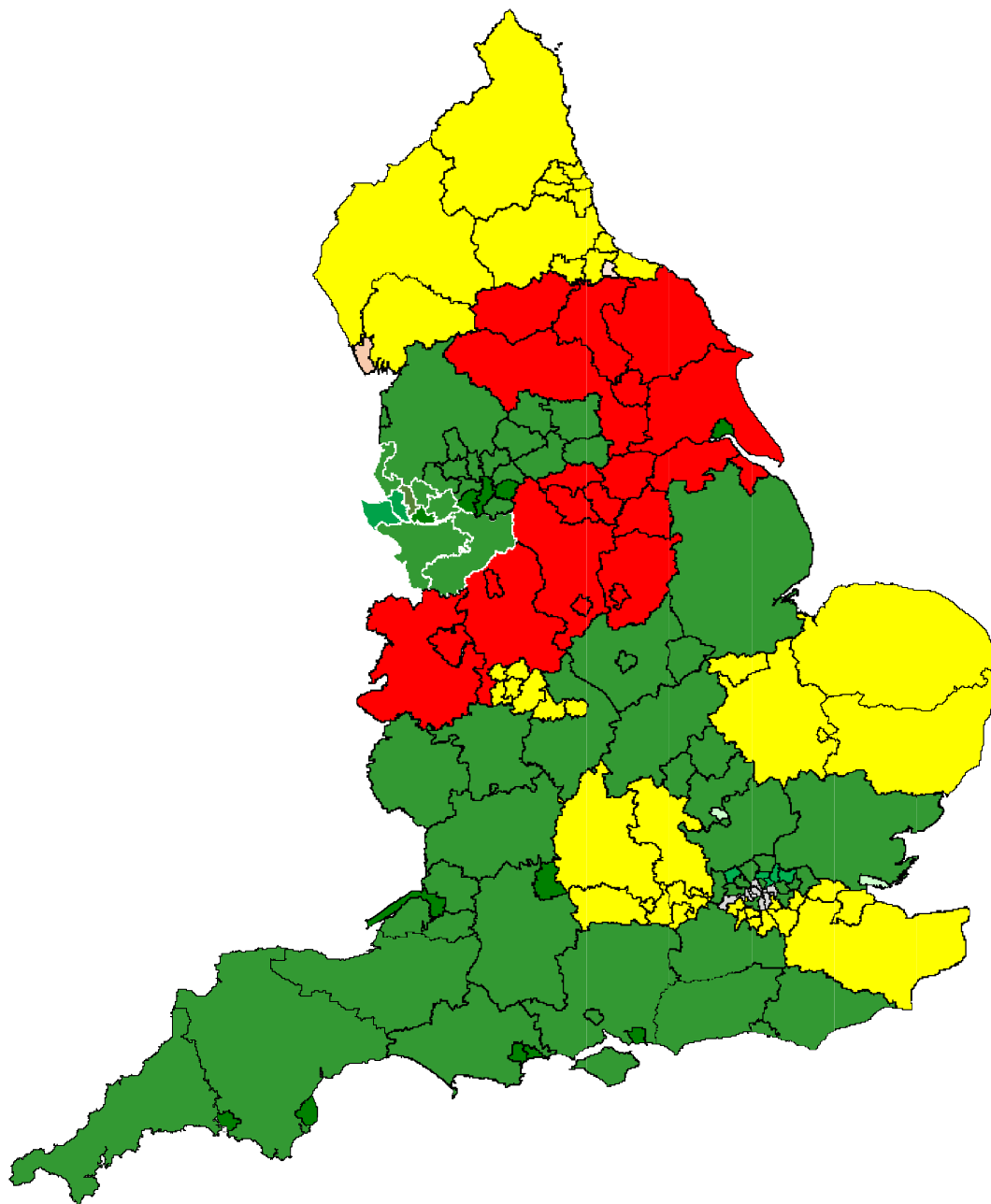


Fig 1. Availability of high and low dose rate brachytherapy in the 27 National Health Service England local area teams (red = no brachytherapy modality available; yellow = one brachytherapy modality available; green = both high and low dose rate brachytherapy available).

there are four specialist MDTs in Greater Manchester, together serving a population of about 3 million, whereas there is only one specialist MDT in North West London serving a population of about 2 million.

The organisational survey received a 100% response rate from the clinical leads of the specialist MDTs. An important limitation of our survey is that it only represents a snap shot of the configuration of specialist prostate cancer services in England in December 2014. The provision of services will continue to evolve, especially following the publication of the national guidelines in 2014 [8], which highlights the need to consider updates of the survey results available on the NPCA's website (www.npca.org.uk).

Another limitation is that we present information on the availability of procedures and services at the specialist MDT level and not on how these are being used. However, the prospective data collection of the NPCA will fill this gap and allow an assessment of the effect of differential availability on access and use of specific procedures and services.

A third limitation is that the survey uses responses that were self-reported by the specialist MDTs' clinical leads. Therefore, we cannot rule out 'desirability bias', pushing responses towards how the clinical lead wants prostate cancer care services to be rather than how they actually are. However, this effect was minimised by only asking factual information as well as by surveying all individual NHS

Trusts within a particular specialist MDT and seeking clarification from the clinical leads where inconsistencies in their responses were observed.

Our results suggest that the uptake of treatment modalities is not a coordinated process within specialist MDTs, but is probably driven separately by the urologists and oncologists within cancer centres. This may explain the 'over penetration' of surgical innovation, with 73% ($n = 35$) of specialist MDTs providing one or more additional surgical procedure (robotic-assisted laparoscopic prostatectomy, HIFU or cryotherapy) despite only 33% offering all core radiotherapy modalities, as described above.

Currently, only 11 of the 54 radiotherapy centres in England provide high dose rate brachytherapy for prostate cancer. Patients potentially have to travel long distances (Figure 1) to access this modality, even within local area teams that have a radiotherapy centre providing low or high dose rate brachytherapy. Several studies have shown how increased travel times reduce the uptake of radiotherapy treatment [25–27]. It remains unknown whether differential access will lead to inequity in outcomes. However, from the analysis of existing cancer registry and Hospital Episode Statistics (HES) data conducted as part of the audit, there is significant national variation observed in the proportion of high-risk/locally advanced prostate cancer patients receiving radical therapy [28]. Access to high dose rate brachytherapy could therefore be a factor.

Commissioning guidelines have been recently published for high and low dose rate brachytherapy. It is recommended that implantation services be developed on the basis of a minimum catchment population of 1.5 million and it is expected that for high dose rate that at least 10 patients are treated per year in each centre and 50 patients for low dose rate, with each oncologist performing 25 cases per year [29]. It is therefore hoped that the cancer strategic clinical networks will ensure adequate access for patients with prostate cancer, especially in view of the current distribution of centres.

The National Institute for Health and Care Excellence (NICE) have issued guidelines recommending that 'commissioners should ensure that robotic systems for the surgical treatment of localised prostate cancer are cost effective by basing them in centres that are expected to perform at least 150 robot-assisted laparoscopic radical prostatectomies per year' [8]. However, the uptake of robot-assisted prostatectomy seems to be rapid and follows a pattern similar to the USA, which has seen a widespread adoption since the early 2000s, both in high- and low-volume centres [30], which seems to be driven by hospitals in order to attract patients [31]. The introduction of a quasi-market within the English NHS means that patients now have a choice of where they receive their treatment, which may explain why a similar process is occurring in England as centres compete for market share [32]. This will inevitably reduce the patient volume per unit. It is well known that the best outcomes are achieved in high-volume units [33].

One way of ensuring that services can be developed through coordination between urology and oncology teams is to create closer collaboration between the two specialities

at the clinical interface. It is recommended that specialist MDTs have an agreed policy enabling patients with early (organ-defined) prostate cancer to have access to a joint specialist uro-oncology clinic where therapeutic options can be discussed with a urologist, oncologist and a clinical nurse specialist before a final treatment decision is made [34]. In England, more than half specialist MDTs offer these specialist clinics. The opportunity for a patient to see both a urologist and an oncologist at the same clinic visit is particularly important given the variation that exists between urologists and oncologists in their recommendations for the treatment of localised and locally advanced prostate cancer [35–37].

The results of the organisational survey can also be used to assess the wider regional variation in the provision of services in England. For example, since April 2015 the commissioning and provision of services in the English NHS has been coordinated by four regional teams: North of England (16 specialist MDTs), Central and East of England (15 specialist MDTs), London (six specialist MDTs) and South of England (13 specialist MDTs) (two specialist MDT hubs are on the boundary of two regions and each is represented in two regions). There seems to be evidence of regional inequity in the availability of robotic-assisted prostatectomy. The percentage of specialist MDTs offering robotic-assisted prostatectomy in the four regions is 69% in North of England, 47% in Central and East of England, 100% in London and 62% in the South of England.

There were also marked differences in the availabilities of HIFU and cryotherapy, which are treatment modalities often used for salvage therapy. For example, seven of the eight specialist MDTs that offer HIFU are based in London and the South of England. Given their specialist nature, centralisation of these services to a small number of expert centres is appropriate, but the reasons for them to be concentrated in London and the South need to be further investigated. It may partly reflect differences in patient populations, in particular the way they act as consumers of care [38–40].

This organisational audit will help to understand the results of our prospective audit on service use of individual patients in England and Wales [5] as well as informing other national initiatives [40].

Conclusion

The organisational survey of the NPCA has provided a comprehensive assessment of the structure and function of specialist MDTs in England and the availability of prostate cancer procedures and services. Considerable geographical variation exists, with respect to the availability of core treatment modalities, the size of target population and catchment areas, and the uptake of additional procedures and services.

The NPCA will provide a periodically updated overview of the organisation of prostate cancer care in England (www.npca.org.uk/reports), which can inform the further development of the organisation of prostate cancer services

in order to ensure that in the future all newly diagnosed patients will have access to the cancer treatments and services in their local area that are most appropriate for their specific needs.

Conflicts of Interest

Heather Payne has attended and received honoraria for advisory boards, travel expenses to medical meetings and served as a consultant for AstraZeneca, Astellas, Janssen, Sanofi Aventis, Takeda, Amgen, Ipsen, Ferring, Sandoz, Roche and Novartis.

Acknowledgements

The authors wish to thank the prostate cancer clinical leads for completing the questionnaires and for providing the annual updates for the National Prostate Cancer Audit. Heather Payne's work was supported by the UCLH/UCL Comprehensive Biomedical Research Centre.

References

- [1] Department of Health. *Improving outcomes: a strategy for cancer* 2011.
- [2] NICE. *Improving outcomes in urological cancers - guidance on cancer services* 2002.
- [3] England NHS. *National cancer peer review programme: manual for cancer services: urology measures* 2014.
- [4] Cathcart P, Nossiter J, Aggarwal A, et al. The first national clinical audit of prostate cancer care. *BJU Int* 2013;112(7):883–884.
- [5] Aggarwal A, Cathcart P, Payne H, et al. The National Prostate Cancer Audit - introducing a new generation of cancer audit. *Clin Oncol* 2014;26(2):90–93.
- [6] Heidenreich A, Bastian P, Bellmunt J, et al. *Guidelines on prostate cancer*. European Association of Urology, www.uroweb.org/gls/pdf/09_Prostate_Cancer_LR.pdf; 2012.
- [7] British Uro-oncology Group (BUG), British Association of Urological Surgeons (BAUS). *Multidisciplinary team (MDT) guidance for managing prostate cancer* 2013.
- [8] NICE. *Prostate cancer: diagnosis and treatment* 2014.
- [9] Ghafar MA, Johnson CW, De La Taille A, et al. Salvage cryotherapy using an argon based system for locally recurrent prostate cancer after radiation therapy: the Columbia experience. *J Urol* 2001;166(4):1333–1338.
- [10] Uchida T, Shoji S, Nakano M, et al. High-intensity focused ultrasound as salvage therapy for patients with recurrent prostate cancer after external beam radiation, brachytherapy or proton therapy. *BJU Int* 2011;107(3):378–382.
- [11] Ficarra V, Novara G, Artibani W, et al. Retropubic, laparoscopic, and robot-assisted radical prostatectomy: a systematic review and cumulative analysis of comparative studies. *Eur Urol* 2009;55(5):1037–1063.
- [12] Hoeks CM, Barentsz JO, Hambrock T, et al. Prostate cancer: multiparametric MR imaging for detection, localization, and staging. *Radiology* 2011;261(1):46–66.
- [13] Hara T, Kosaka N, Kishi H. PET imaging of prostate cancer using carbon-11-choline. *J Nucl Med* 1998;39(6):990–995.
- [14] Ahmed HU, Hu Y, Carter T, et al. Characterizing clinically significant prostate cancer using template prostate mapping biopsy. *J Urol* 2011;186(2):458–464.
- [15] King CR, Freeman D, Kaplan I, et al. Stereotactic body radiotherapy for localized prostate cancer: pooled analysis from a multi-institutional consortium of prospective phase II trials. *Radiother Oncol* 2013;109(2):217–221.
- [16] McDowell I. *Measuring health: a guide to rating scales and questionnaires*. Oxford: Oxford University Press; 2006.
- [17] Cancer Research UK. *The Radiotherapy Innovation Fund - an evaluation of the Prime Minister's £23 million fund* 2013.
- [18] NHS Choices - your health, your choices. Available at: <http://www.nhs.uk/Pages/HomePage.aspx>.
- [19] NHS Commissioning Board. *NHS Commissioning Board: local area teams* 2012.
- [20] Office for National Statistics. Cancer survival by NHS England Area Team: adults diagnosed 1997–2012, followed up to 2013. Available at: <http://www.ons.gov.uk/ons/rel/cancer-unit/cancer-survival-by-nhs-england-area-teams/adults-diagnosed-1997-2012-followed-up-to-2013/stb-cancer-survival-by-nhs-england-area-team.html>.
- [21] Martinez AA, Gonzalez J, Ye H, et al. Dose escalation improves cancer-related events at 10 years for intermediate-and high-risk prostate cancer patients treated with hypofractionated high-dose-rate boost and external beam radiotherapy. *Int J Radiat Oncol Biol Phys* 2011;79(2):363–370.
- [22] Hoskin P, Rojas A, Lowe G, et al. High-dose-rate brachytherapy alone for localized prostate cancer in patients at moderate or high risk of biochemical recurrence. *Int J Radiat Oncol Biol Phys* 2012;82(4):1376–1384.
- [23] Sylvester JE, Grimm PD, Wong J, Galbreath RW, Merrick G, Blasko JC. Fifteen-year biochemical relapse-free survival, cause-specific survival, and overall survival following ¹²⁵I prostate brachytherapy in clinically localized prostate cancer: Seattle Experience. *Int J Radiat Oncol Biol Phys* 2011;81(2):376–381.
- [24] Prada PJ, Juan G, González-Suárez H, et al. Prostate-specific antigen relapse-free survival and side-effects in 734 patients with up to 10 years of follow-up with localized prostate cancer treated by permanent ¹²⁵I implants. *BJU Int* 2010;106(1):32–36.
- [25] Punglia RS, Weeks JC, Neville BA, Earle CC. Effect of distance to radiation treatment facility on use of radiation therapy after mastectomy in elderly women. *Int J Radiat Oncol Biol Phys* 2006;66(1):56–63.
- [26] Jones A, Haynes R, Sauerzapf V, Crawford S, Zhao H, Forman D. Travel time to hospital and treatment for breast, colon, rectum, lung, ovary and prostate cancer. *Eur J Cancer* 2008;44(7):992–999.
- [27] Athas WF, Adams-Cameron M, Hunt WC, Amir-Fazli A, Key CR. Travel distance to radiation therapy and receipt of radiotherapy following breast-conserving surgery. *J Natl Cancer Inst* 2000;92(3):269–271.
- [28] Royal College of Surgeons of England - Clinical Effectiveness Unit. *National Prostate Cancer Audit - First Year Annual Report - Organisation of Services and Analysis of Existing Clinical Data* 2014.
- [29] NHS England. *2013/2014 NHS Standard Contract for Brachytherapy NHS England* 2013.
- [30] Chang SL, Kibel AS, Brooks JD, Chung BI. The impact of robotic surgery on the surgical management of prostate cancer in the USA. *BJU Int* 2015;115(6):929–936.
- [31] Barbash GI, Glied SA. New technology and health care costs — the case of robot-assisted surgery. *New Engl J Med* 2010;363(8):701–704.
- [32] Bevan G, Skellern M. *Does competition between hospitals improve clinical quality? A review of evidence from two eras of competition in the English NHS* 2011.

- [33] Vesey SG, McCabe JE, Hounsoms L, Fowler S. UK radical prostatectomy outcomes and surgeon case volume: based on an analysis of the British Association of Urological Surgeons Complex Operations Database. *BJU Int* 2012;109(3):346–354.
- [34] National Cancer Peer Review Programme (England). *Urology specific measures*. London: NHS; 2013.
- [35] Fowler Jr FJ, Collins MM, Albertsen PC, Zietman A, Elliott DB, Barry MJ. Comparison of recommendations by urologists and radiation oncologists for treatment of clinically localized prostate cancer. *JAMA* 2000;283(24):3217–3222.
- [36] McNaughton Collins M, Barry MJ, Zietman A, et al. United States radiation oncologists' and urologists' opinions about screening and treatment of prostate cancer vary by region. *Urology* 2002;60(4):628–633.
- [37] Kim SP, Gross CP, Nguyen PL, et al. Perceptions of active surveillance and treatment recommendations for low-risk prostate cancer: results from a national survey of radiation oncologists and urologists. *Medical Care* 2014;52(7):579–585.
- [38] Lee C-J, Gray SW, Lewis N. Internet use leads cancer patients to be active health care consumers. *Patient Educ Counsel* 2010;81:S63–S69.
- [39] Nagler RH, Gray SW, Romantan A, et al. Differences in information seeking among breast, prostate, and colorectal cancer patients: results from a population-based survey. *Patient Educ Counsel* 2010;81:S54–S62.
- [40] National Cancer Intelligence Network (NCIN). *Treatment routes in prostate cancer - urological cancers SSCRG* 2012.