Attitudes and experience of urology trainees in interpreting prostate magnetic resonance imaging

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Abstract

Introduction: Multiparametric magnetic resonance imaging (mpMRI) has resulted in accurate prostate cancer localization and image-guided targeted sampling for biopsy. Despite its more recent uptake, knowledge gaps in interpretation and reporting exist. Our objective was to determine the need for an educational intervention among urology residents working with mpMRIs.
Methods: We administered an anonymous, cross-sectional, self-report questionnaire to a convenience sample of urology residents in U.S. and Canadian training programs. The survey included both open- and closed-ended questions employing a five-point Likert scale. It was designed to assess familiarity, exposure, experience, and comfort with interpretation of mpMRI.
Results: Fifty-three surveys were completed by residents in postgraduate years (PGY) 1–5 and of these, only 12 (23%) reported any formal training in mpMRI interpretation. Most residents' responses demonstrated significant experience with prostate biopsies, as well as familiarity with reviewing mpMRI for these patients. However, mean (± standard deviation) Likert responses suggested a relatively poor understanding the components of Prostate Imaging–Reporting and Data System (PI-RADS) v2 scoring for T2 weighted films (2.45±1.01), diffusion-weighted imaging (DWI) films (2.26±0.90), and dynamic contrast-enhanced (DCE) films (2.21±0.99). Similar disagreement scores were observed for questions around interpretation of the different functional techniques of MRI images. Residents reported strong interest (4.21±0.91) in learning opportunities to enhance their ability to interpret mpMRI.
Conclusions: While mpMRI of the prostate is a tool frequently used by care teams in teaching centers to identify suspicious prostate cancer lesions, there remain knowledge gaps in the ability

of trainees to interpret images and understand PI-RADS v2 scoring. Online modules were suggested to balance the needs of trainee education with the residency workflow.

Introduction

The evolution of our health system has been accompanied by an increasing demand for healthcare services and administration which may limit instruction focus and time for learners. As medical training across Canada moves toward competency-based curricula, it has become clear that expertise is developed by exposure to high quality teaching followed by ample opportunity to practice and incrementally develop knowledge and skills. A key issue lies in a relative lack of resources and support necessary to facilitate deliberate attainment of these competencies.[1] The limitations have resulted in a call for institutions to develop innovative ways to more efficiently train residents. Self-directed learning via online platforms has been shown to improve trainee outcomes, including effective development of new diagnostic skills.[2,3] As a simulated environment allows for no risk to actual patients, trainees can feel comfortable increasing skills through trial and error.[4]

Owing to its high soft-tissue contrast, high resolution, and ability to simultaneously image functional parameters, MRI provides the best visualisation of the prostate compared to other imaging methods. Over the past few years, using MRI has led to a frameshift for early prostate cancer detection. Functional imaging techniques, such as diffusion-weighted MRI (DW-MRI) and dynamic contrast-enhanced MRI (DCE), in addition to conventional T2-weighted anatomical sequences (i.e. multiparametric MRI, mpMRI), have resulted in accurate PCa localization and allowed image-guided targeted sampling to overcome the limitations of traditional blind prostate biopsy. Large randomized trials have now confirmed the importance of optimal imaging with mpMRI in the early diagnosis-and subsequent management-of prostate cancer.[5,6] Unfortunately, utilization of mpMRI has become story of "haves" and "have nots".[7,8] Democratizing access to optimal prostate imaging, as well as enhancing the ability for clinicians to interpret mpMRI images, has real potential to enhance the care of all men being investigated for this common cancer, regardless of economical and geographical barriers.

Our centre has developed an online platform for residents to learn more about interpreting mpMRI as a diagnostic tool in prostate cancer. This system known as ***prostatecancer.ai***, available online and through a browser, employs artificial intelligence (AI) to identify lesions on mpMRI images and annotate findings with a thought-process comparable to an experienced radiologist (Figure 1).[9] These scans are then presented as practice exercises to trainees with an accessible answer key. Urology residents can test their skills with hundreds of de-identified scans and ultimately practice reporting using PI-RADS v2—a standard reporting

methodology intended to optimize detection, localization, characterization and risk stratification in patients with suspected prostate cancer.

While in theory self-directed learning may be beneficial, there is limited consensus on current urology residents' attitudes towards utilisation of online teaching platforms to learn about the role of MRI in prostate cancer. This study aimed to quantify the need for an educational intervention among urology residents working with mpMRIs and PI-RADS v2.

Methods

Based on previously published methods for the creation of quantitative surveys, a needs assessment approach was used to determine the comfort level of urology residents working with mpMRI images and PI-RADS v2 reporting.[10-13] Questions were drafted based on the following themes (a) experience and comfort with reading and interpretation of mpMRI images (b) confidence with the use, and components of, PI-RADS v2 (c) interest in educational opportunities in mpMRI and PI-RADS v2.

The survey contained questions about respondent demographics as well as their experience of the use of mpMRI in their centre with answers graded between "never" and "always". Finally, there were a series of questions on their comfort with interpreting mpMRI as well as their educational experiences focused on prostate imaging ranked on a Likert agreement scale, ranging from 1 *(Not at All)* to 5 *(Strongly Agree*). The survey was developed by a team of staff and trainees and tested for readability and face validity by staff urologists and residents in both the US and Canada. The survey concluded with one free-form open-ended question inviting the trainees to share their thoughts on how best to delivery educational method(s).

The survey was delivered to both US and Canadian urology trainees as a convenience sample including residents ranging from post graduate year 1 to 5 (PGY1-PGY5). The survey was delivered opportunistically in hard copy at resident research and educational meetings between April 2019-December 2019.

Ethics approval was attained from the Queen's University Institutional Review Board, and an information package describing the motives, objectives, and confidentiality of the study were distributed with the surveys. Data was analyzed using descriptive statistics. Frequencies were tabulated and means with standard deviations used, as appropriate, to describe responses on the Likert scale. In cases where a participant responded with a range rather than a single value, the midpoint was used for analysis. For the purposes of reporting on questions using the five-point Likert scale, the agreement responses 4 and 5 were grouped together, as were the disagreement responses 1 and 2, unless otherwise stated. All other quantitative statistics used the full five-point Likert scale. The non-parametric Mann–Whitney U test was used to compare responses between different cohorts.

Results

Demographic data of respondents are found in Table 1. Of the 53 surveys that were completed by PGY1 to PGY5 residents, 32 (61%) were in their 5th year of the program. There were 5 fourth year residents, 5 third year residents, 7 second year residents and 2 first year residents in the survey sample. Thirty two residents were from Canada and 21 were from the US. Most of the residents (91%) documented that they had previously performed prostate biopsies, with 31 residents performing 1-20 and 19 residents performing 21 or more biopsies in the past. When asked how many prostate mpMRI they had personally thoroughly reviewed, most (n=43, 81%) responded some experience although only 10% documenting they had read more than 30 scans. Despite this, only 12 (23%) residents, responded that they had received training in mpMRI interpretation through a formal course or lecture.

Table 2 documents the respondent's experience of mpMRI in clinical practice at their institutions. When asked how often patients receive mpMRI scans prior to initial prostate biopsy, 11 (21%) of residents responded "often" or "always" but 26% responded never in their experience. On the contrary, 38 (72%) of the residents responded "often" or "always" to how often patients receive prostate mpMRI scans prior to repeat biopsy. When asked about their experience the use of mpMRI and the change in practice, half of the respondents felt that information from the mpMRI "often" or "always" led to changes in biopsy technique. Despite what appeared to be moderate experience of mpMRI in clinical practice within their institutions, only a small minority of residents (19%) responded they routinely read their own mpMRI prior to considering/planning a prostate biopsy with 51% of residents indicating "never".

The rest of the survey questions focused on the residents understanding and comfort with interpretation of prostate MRI and specifically the components of the multiple parameters within PIRADS v2 scoring (Table 3). With a mean Likert score of 2.45 (+/- 1.01 standard deviation (SD), 34 (64%) residents "strongly disagreed" or "disagreed" with the statement suggesting they understand components/findings in PIRADS v2 scoring for T2W films. Similarly, 36 (68%) residents responded "strongly disagreed" or "disagreed" when asked a similar question around understanding of DWI components (mean Likert score 2.26 +/- 0.90 SD) and DCE (2.92 +/- 1.11 SD). Although still dichotomous, the residents responded slightly more positively when asked about their comfort in interpreting the different functional imaging techniques compared to their understanding of the components of PIRADS v2 scoring. Residents' agreement in their ability to interpret T2W films was 23% (2.43 +/- 1.06 SD) compared to DWI films 47% (2.92 +/- 1.11 SD) and DCE films 40% (3.08 +/- 1.30 SD).

Fifty five percent of residents responded with survey answers to suggest they were not comfortable reviewing and subsequently confirming the radiologists' interpretation of a mpMRI images. When questioned about the test characteristics of mpMRI use within their own institutions the responses appeared generally negative with only 34% agreement that the residents understand the likelihood of cancer between lesions graded between PIRADS 3-5 and

only 26% agreement in their confidence with the specificity of overall PIRADS 4-5 lesions. We have compared differences in responses amongst the more junior and more senior trainees (≥ PGY3 and < PGY3 residents). There were a few differences found in some of the main attitudinal questions within the survey, particularly when asked about comfort in interpretation of DWI MRI parameters (3.14± 1.07 SD vs. 1.89± 0.60, p< 0.01 respectively). Although this finding is consistent with more educational opportunities due to seniority it was interesting that there were no significant differences in many of the other survey questions between more junior and more senior residents including their understanding of the components/findings in PIRADS v2 scoring. Although there appeared to be similar differences between US and Canadian respondents, these were confounded by different years of training between these two cohorts (less <PGY3 in the Canadian trainees). On average, residents agreed they would be interested to learn about further opportunities to improve their ability to read mpMRI films (4.21 +/- 0.91 SD), with the majority (80%) responding "agree" or "strongly agree". Some examples of resident's preferred methods for enhancing skills in mpMRI interpretation included "online courses, modules and interactive presentations".

Discussion

This cross-sectional self-report survey study suggests that although mpMRI of the prostate is a tool frequently used by care teams in teaching centres to identify suspicious prostate cancer lesions (particularly after a previous biopsy), there remain significant knowledge gaps in the ability of trainees to interpret images and understand PIRADS v2 scoring. Although most respondents described some modest experience with personal review of mpMRI images of the prostate, only a small number (23%) suggested that they had received any training in mpMRI interpretation through a formal course or lecture. Furthermore, only a minority of residents responded that they routinely personally review prostate mpMRI prior to clinical decision making which is, experientially, quite disparate from other GU imaging techniques.

On average, residents described difficulty in understanding the components of PIRADs v2 scoring regardless of the MRI imaging technique (i.e. T2W, DWI, DCE). The lowest trended score was demonstrated to be among DCE parameters although few responded strong agreement that they had a fulsome understanding of any of the functional imaging techniques of mpMRI scoring. Interestingly, residents appeared to be more comfortable reviewing and interpreting mpMRI images relative to their understanding of the PI-RADS v2 scoring system, perhaps as they would be privy to a radiologist reporting of suspicious lesions prior to reviewing specific cases. Indeed, most trainees confirmed that they were not comfortable in reviewing and subsequently confirming a radiologist's interpretation of a mpMRI images. Furthermore, residents did not acknowledge a strong level of comfort discerning the differences (i.e. likelihood of cancer) between PIRADs lesions scored as 3, 4 or 5. In contrast with what appears to be a relative lack of knowledge and comfort with utilizing prostate mpMRI, the respondent trainees in

this survey do appear to be highly engaged in learning opportunities that could help develop skills in mpMRI interpretation.

Although the results of this self-report survey did underscore a knowledge gap in prostate mpMRI interpretation, the survey content did not adequately address the specific teaching platforms that could best address this need. However, several comments from respondents did suggest that an online platform would be helpful to fill this gap. Previous studies have shown that a self directed learning strategy may achieve trainee competence in specific imaging modalities.[14] Furthermore integration of online modular learning has shown to benefit hospital staff and balance the needs of trainee education with the workflow of attending staff with pressing clinical duties.[15,16] Future studies should assess the limitations of self-directed learning and its value of being a complementary—as opposed to supplementary—source of education for trainees. Beyond the need for self-discipline and accountability, the main trade-off between online vs. in-person/on-site practice relates to the limited emotional and physical interaction a learner has with an educator who may be able to tailor teaching and address concerns in real time[7]. More research is needed to determine if an online tool such as *prostatecancer.ai* and its model of teaching is a sustainable, realistic approach that can significantly improve diagnostic accuracy for residents.

Conclusions

Although, the results of this survey provide a quantitative assessment of the need and interest for learning opportunities for urology residents, there are several limitations inherent to a study design that need to be considered. First, the results are derived from a self-report survey on the experience and attitudes of contemporary residents towards mpMRI and independent verification of data was not possible. Secondly, this survey represents only a snapshot of self-reported attitudes and experience of residents from different years of training. However, most of the respondents were in their senior years of training, close to completion of their programs, and likely have had multiple opportunities and experiences of their educational curricula set out by their respective programs. Thirdly, this was a somewhat small sample size with mixed resident population (US and Canada) and variable methods to approach the residents. The overall response rate was not captured. Nonetheless, the generally high number of responses, especially from the senior Canadian residents, likely is a good representation of the experience and attitudes.

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Figures and Tables

Fig. 1. Sample photo of ***prostatecancer.ai***: an online tool, built on Open Health Imaging Foundation Viewer that utilizes employing artificial intelligence (AI) to identify lesions on multiparametric magnetic resonance images and annotate findings with a thought-process comparable to an experienced radiologist.

Table 1. Demographic information about survey respondents						
Demographic	**Proportion of residents % (n= 53)**					
Year of training	2 PGY5+	32 PGY5	5 PGY4	5 PGY3	7 PGY2	2 PGY1
Country of practice	60.5 % (32) CAN			39.5 % (21) USA		
Residents who received formal mpMRI training	22.6 % (12)					
Residents who personally have reviewed (#) mpMRI scans	73.6% (39) 0–10		15.1% (8) 11–30		11.3% (6) >30	

mpMRI: multiparametric magnetic resonance imaging; PGY: postgraduate year.

Table 2. Experience of mpMRI use during practice for urology residents				
	Number of residents (n=53)			
	Never	**Sometimes**	**Often**	**Always**
At your institution how often do patients receive mpMRI prior to initial biopsy?	14	28	10	1
At your institution how often do patients receive mpMRI prior to repeat biopsy?	1	14	31	7
In your estimation how often does a prior mpMRI change biopsy technique?	2	24	22	5
I read my own mpMRI prior to considering/planning prostate biopsy?	27	16	6	4

mpMRI: multiparametric magnetic resonance imaging.

Table 3. Likert scores assessing urology residents understanding and confidence of interpreting mpMRI films and PI-RADS v2 scoring					
Number of residents (n=53)					
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
I understand the components/findings in PI-RADS v2 scoring for T2W films?	7	27	8	10	1
I understand the components/findings in PI-RADS v2 scoring for DWI films?	9	27	12	4	1
I understand the components/findings in PI-RADS v2 scoring for DCE films?	14	21	11	2	0
I am comfortable in my ability to interpret a T2W MRI film?	11	20	10	12	0
I am comfortable in my ability to interpret a DWI MRI film?	7	14	7	18	7
I am comfortable in my ability to interpret a DCE MRI film?	5	17	10	19	2
I am comfortable in reviewing and subsequently confirming the interpretation of our radiologists read of a mpMRI	9	20	9	14	1
I understand the difference (likelihood of cancer) between lesions graded as overall PI-RADS score 3, 4, 5	8	15	10	13	5
I am confident with the specificity (few false positive reads) of overall PI-RADS 4–5 lesions at out institution	8	17	18	13	1
I am interested in learning opportunities that will develop my skills in mpMRI interpretation	0	3	8	17	25

DCE: dynamic contrast-enhanced; DWI: diffusion-weighted imaging; mpMRI: multiparametric magnetic resonance imaging; PI-RADS: Prostate Imaging–Reporting and Data System; T2W: T2 weighted image.

Supplementary Table 1. Differences between ≥PGY3 and <PGY3 residents' attitudes and experiences while interpreting prostate MRI			
Question	**Mean Likert score**		
	≥PGY3 n=44	**<PGY3 n=9**	**Mann-Whitney U-test (p<0.05)**
I understand the components/findings in PI-RADS v2 scoring for T2W films?	2.52±1.05	2.11±0.78	0.23
I understand the components/findings in PI-RADS v2 scoring for DWI films?	2.32±0.91	2.00±0.87	0.30
I understand the components/findings in PI-RADS v2 scoring for DCE films?	2.25±1.01	2.00±0.87	0.52
I am comfortable in my ability to interpret a T2W MRI film?	2.55±1.11	1.89±0.60	0.12
I am comfortable in my ability to interpret a DWI MRI film?	3.32±1.27	1.89±0.60	0.004
I am comfortable in my ability to interpret a DCE MRI film?	3.14±1.07	1.89±0.60	0.003
I understand the difference (likelihood of cancer) between lesions graded as overall PI-RADS score 3, 4, 5	2.84±1.22	3.11±1.54	0.60

DCE: dynamic contrast-enhanced; DWI: diffusion-weighted imaging; mpMRI: multiparametric magnetic resonance imaging; PGY: postgraduate year; PI-RADS: Prostate Imaging–Reporting and Data System; T2W: T2 weighted image.

Supplementary Table 2. Differences between Canadian and U.S. residents' attitudes and experiences while interpreting prostate MRI			
Question	**Mean Likert score**		
	Canada n= 32	**U.S. n= 21**	**Mann-Whitney U-test (p<0.05)**
I understand the components/findings in PI-RADS v2 scoring for T2W films?	2.47±1.04	2.43±0.98	0.80
I understand the components/findings in PI-RADS v2 scoring for DWI films?	2.19±0.86	2.38±0.97	0.67
I understand the components/findings in PI-RADS v2 scoring for DCE films?	2.03±0.97	2.48±0.98	0.15
I am comfortable in my ability to interpret a T2W MRI film?	2.69±1.12	2.05±0.86	0.04

I am comfortable in my ability to interpret a DWI MRI film?	3.81±1.03	1.95±0.74	< 0.00001
I am comfortable in my ability to interpret a DCE MRI film?	3.53±0.84	2.00±0.77	< 0.00001
I understand the difference (likelihood of cancer) between lesions graded as overall PI-RADS score 3, 4, 5	2.44±1.01	3.57±1.33	0.00244

DCE: dynamic contrast-enhanced; DWI: diffusion-weighted imaging; mpMRI: multiparametric magnetic resonance imaging; PI-RADS: Prostate Imaging–Reporting and Data System; T2W: T2 weighted image.