

Supplementary Methods

Development cohort – center 1 - image acquisition

Magnetic resonance imagings (MRI) were obtained at 3 Tesla (Achieve 3.0 T TX, Philips Healthcare) using a 16-channel phase array surface with or without endorectal coils (BPX-30, Medrad). An expert genitourinary radiologist with 20 years of experience evaluated all scans prospectively from 2008 to 2018. The scans that were obtained between May 2015 and 2018 were prospectively evaluated according to the PI-RADS v2.0 guidelines, and those imaged between January 2008 and May 2015 were retrospectively re-evaluated using PI-RADS v2.0. Imaging sequences included T2-weighted imaging (T2W), apparent diffusion coefficient map, high b-value ($b = 2000$ or 1500 s/mm^2) diffusion-weighted imaging (DWI), and dynamic contrast-enhanced MRI (DCE). For some patients (prior to December 2011), MRI acquisition protocol did not include a high b-value DWI, so these were calculated at $b = 1500 \text{ s/mm}^2$ to account for these patients. DCE MRI was not used (Supplementary Table 1).

Center 1 biopsy readers and methods

An expert urologist with 23 years of experience and expert interventional radiologist with 21 years of experience performed all biopsies transrectally or transperineally. The surgical procedures were carried out (robotically, DaVinci) by the same urologist and another urologist with 6 years of experience. An expert genitourinary pathologist with 45 years of experience evaluated all biopsy and RP specimens while blinded to the MRI reports.

External validation cohort – center 2 - image acquisition

MRIs at center 2 were obtained at either 1.5 Tesla (Magnetom Aera; Siemens Healthcare, Erlangen, Germany or Achieva; Philips Healthcare, Best, the Netherlands or Signa Explorer 1.5T; GE Healthcare, Milwaukee, WI, USA; $n = 188$) or 3 Tesla (Signa Architect 3T; GE Healthcare, Milwaukee, WI, USA $n = 110$). PI-RADSv2.1 scoring was prospectively assessed by 2 radiologists with more than 10 years of experience in reading prostate MRIs. See Figure 1 for patient population criteria at each center.

Center 2 biopsy readers and methods

An expert urologist with 15 years of experience and three expert interventional radiologists, each with at least 10 years of experience, performed all biopsies transrectally or transperineally. 60% of the cases were performed robotically (DaVinci xi), and 40% were done using a conventional approach by the same urologist. An expert genitourinary pathologist with 10 years of experience evaluated all biopsy and radical prostatectomy specimens.