# Využitie AI pri MR diagnostike karcinómu prostaty

MUDr. Víťazoslav Belan, PhD.

# Úvod

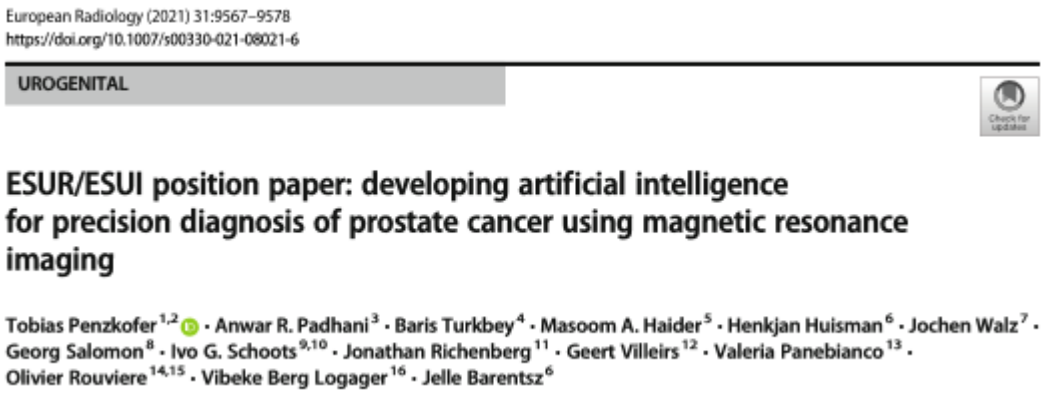
2012 - ESUR - MR prostaty PIRADS (Prostate Imagining Reporting and Data System)
2019 – EAU: MR prostaty pred biopsiou
2022 – potenciál pre skríning karcinómu prostaty ( CaP)
2022 – EU rezolúcia rozšírenie skríningu nádorov vrátane CaP ( zahrňujúca MR prostaty)

P. Puech: How should we prepare a generation of radiologists for MRI-based prostate cancer screening? European Radiology, https://doi.org/10.1007/s00330-023-09680-3

Válek V (2022) Council recommendation of 9 December 2022 on strengthening prevention through early detection: a new EU approach on cancer screening. Off J Eur Union. C473:01

# Úvod

- Kvalifikácia, certifikácia rádiológov a zobrazovacích centier
- Dvojité čítanie
- Využitie AI ( umelej inteligencie) v MR prostaty



European Radiology (2021) 31:9567–9578
https://doi.org/10.1007/s00330-021-08021-6

UROGENITAL

**ESUR/ESUI position paper: developing artificial intelligence for precision diagnosis of prostate cancer using magnetic resonance imaging**

Tobias Penzkofer[1,2] · Anwar R. Padhani[3] · Baris Turkbey[4] · Masoom A. Haider[5] · Henkjan Huisman[6] · Jochen Walz[7] · Georg Salomon[8] · Ivo G. Schoots[9,10] · Jonathan Richenberg[11] · Geert Villeirs[12] · Valeria Panebianco[13] · Olivier Rouviere[14,15] · Vibeke Berg Logager[16] · Jelle Barentsz[6]

# Pro Diagnostic Group structure

PRO DIAGNOSTIC GROUP, a. s.

PRO DIAGNOSTIC GROUP a. s.

**MRI Centres:**

MEDICÍNA nové zámky

MR LEVICE magnetická rezonancia

PRO MAGNET magnetická rezonancia prešov

PRO MAGNET magnetická rezonancia košice

MR POPRAD magnetická rezonancia

DR. MAGNET magnetická rezonancia ružinov

DR. MAGNET ružinovská poliklinika

DR. MAGNET magnetická rezonancia kramáre

MR ŽILINA magnetická rezonancia

PRO DIAGNOSTIKA magnetická rezonance a rtg praha - liboň

**PET/CT Centre:**

DR. MAGNET PET/CT centrum

**CT Centre:**

CT PREŠOV počítačová tomografia

**Multimodality Centre:**

PRO RTG počítačová tomografia • usg • rtg

**Nuclear medicine:**

VIVAMED oddelenie nukleárnej medicíny

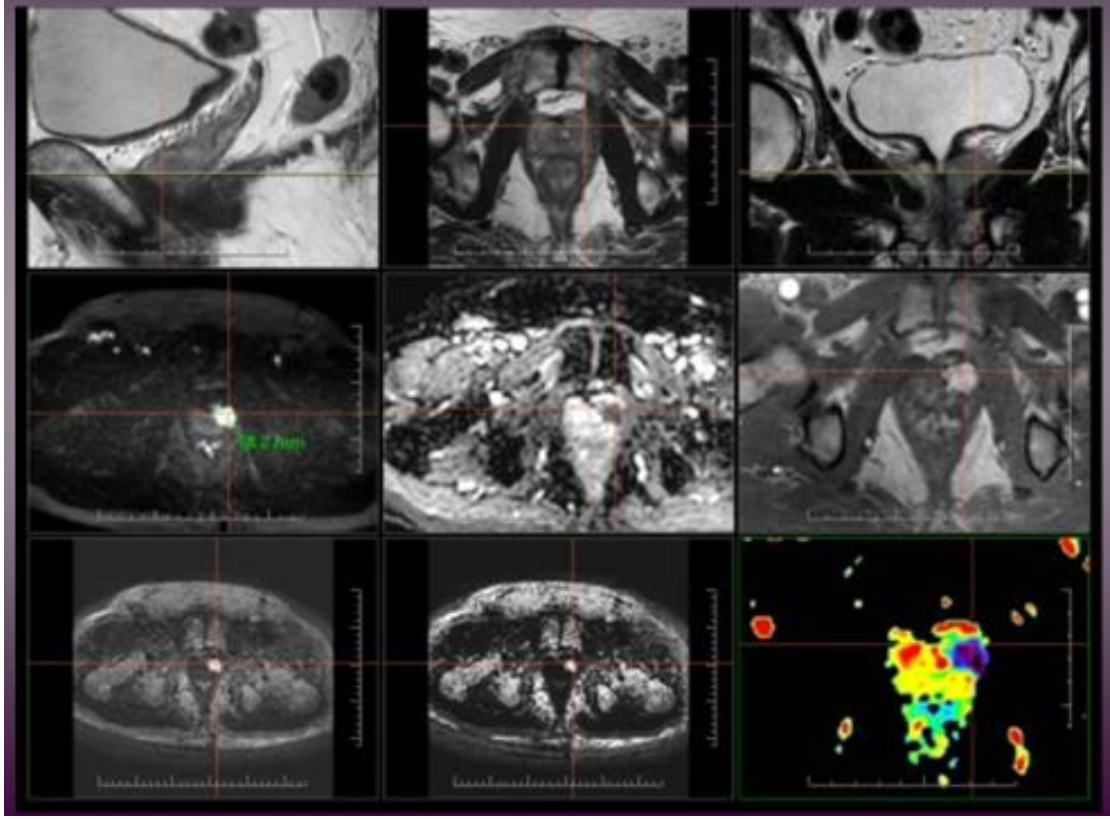
**Densitometry:**

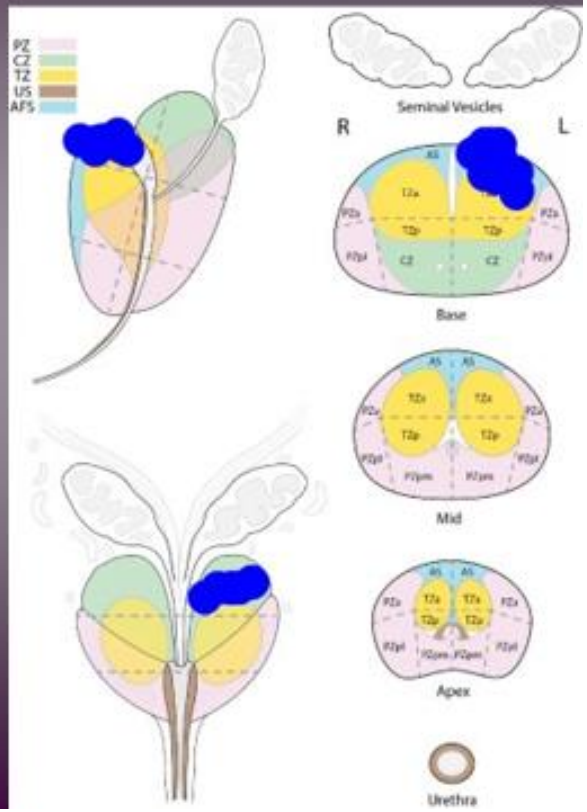
PREAMED denzitometria

TUR (11/2017). PSA 5,52ng/ml, PSAD = 0.13ng/ml².

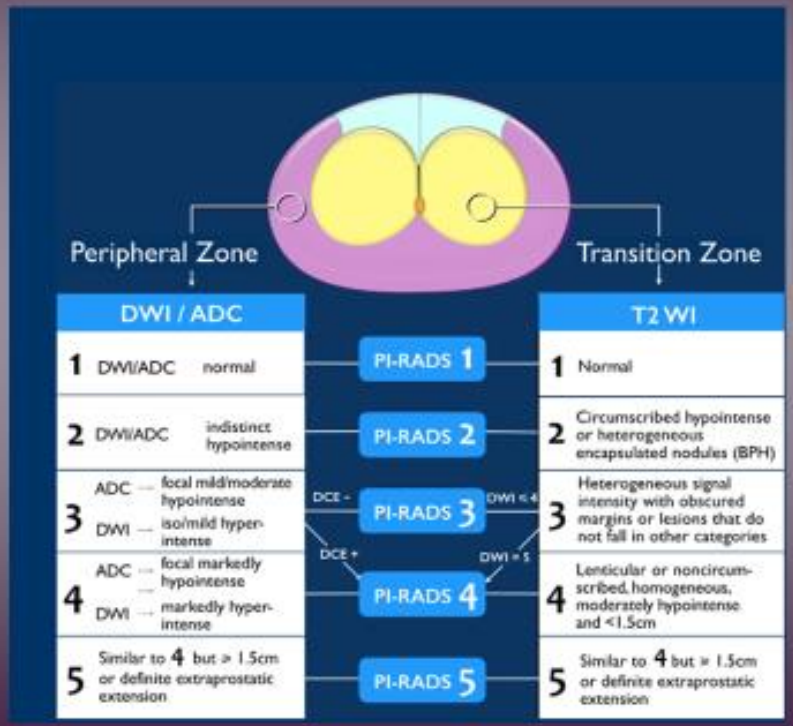
mpMR 1200 images

36x54x42mm (APxLLxCC), volume cca 42.5ml

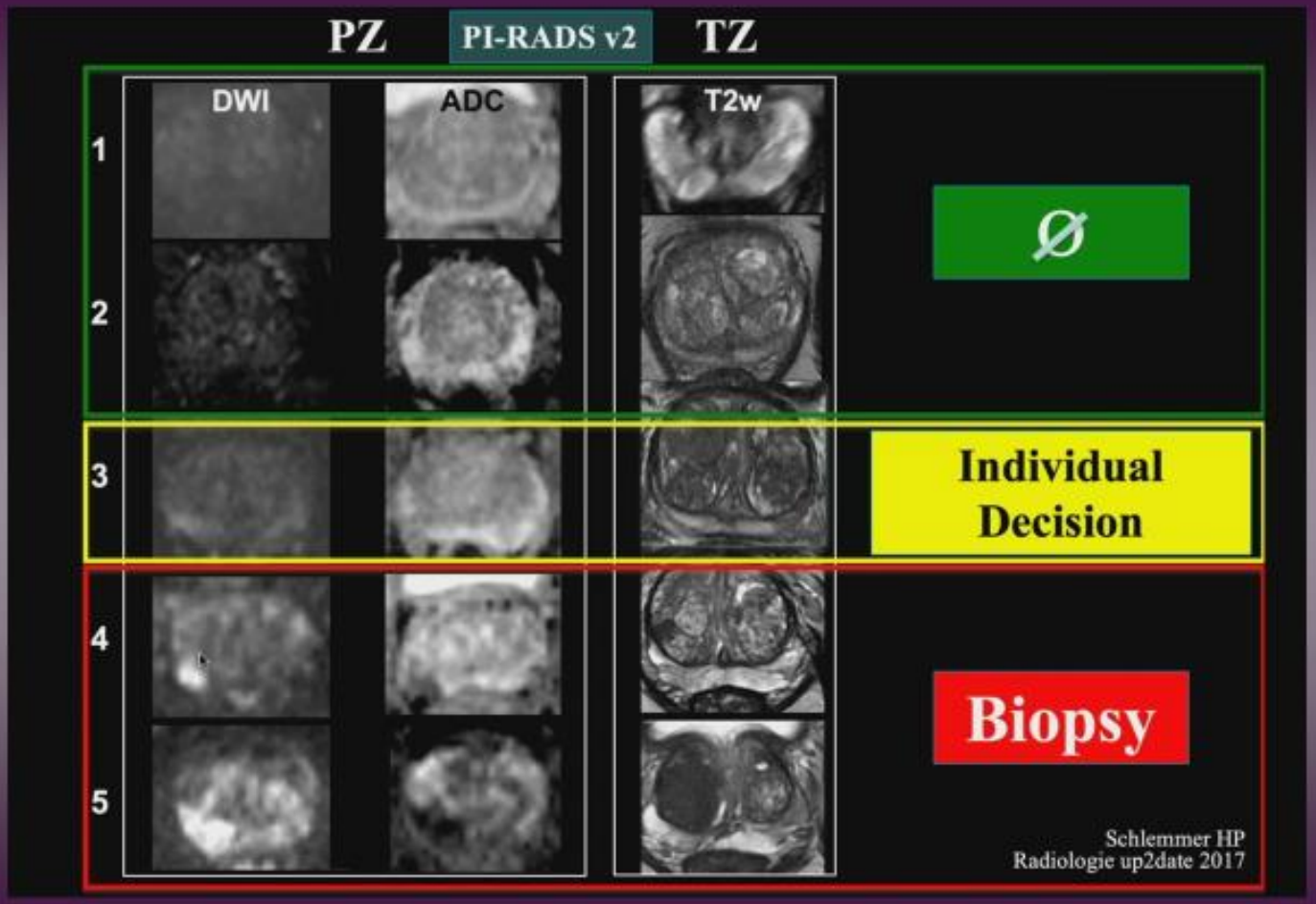




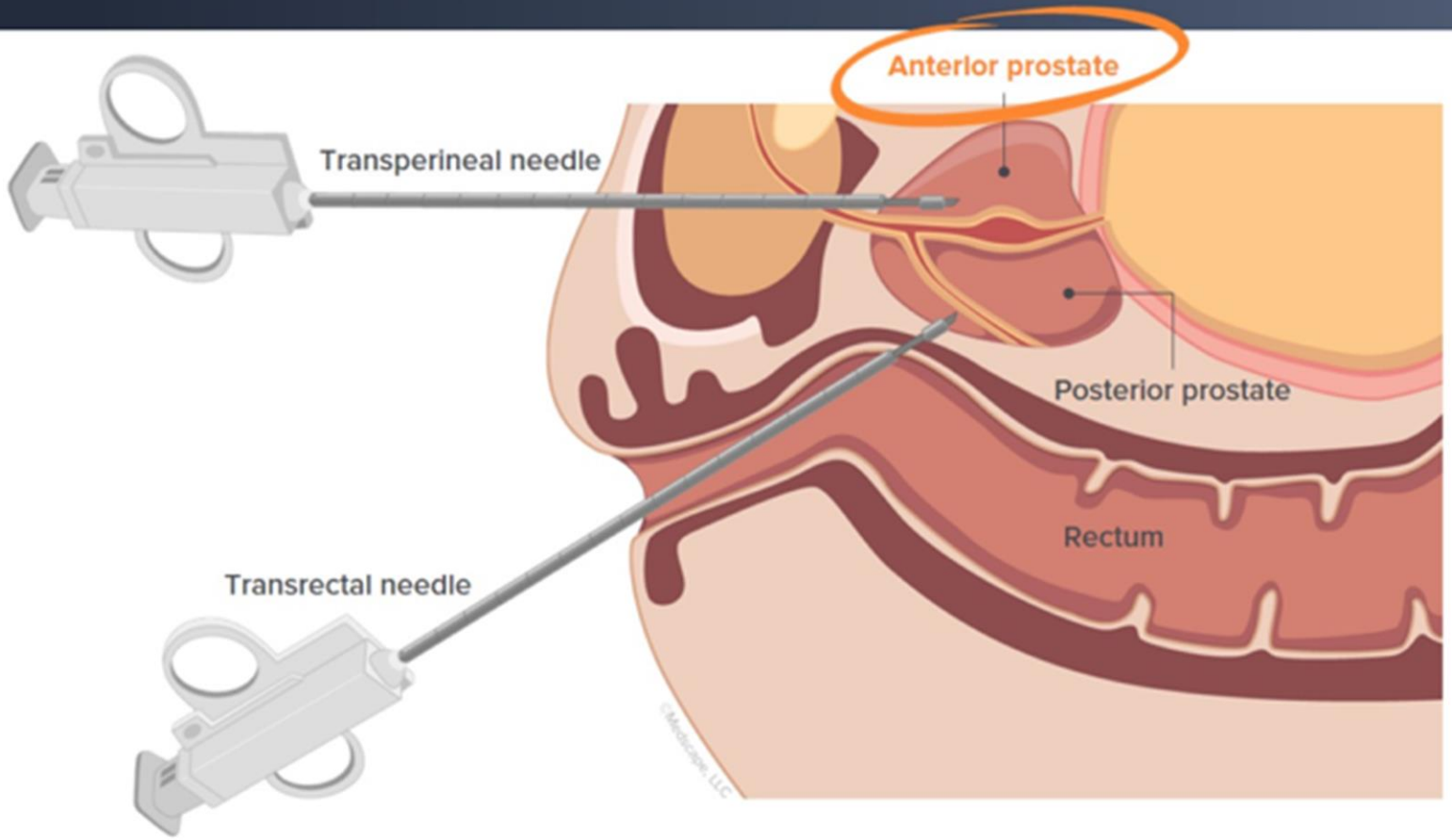
# Prostate Imaging Reporting and Data System (PI-RADS)




Radiology Assistant

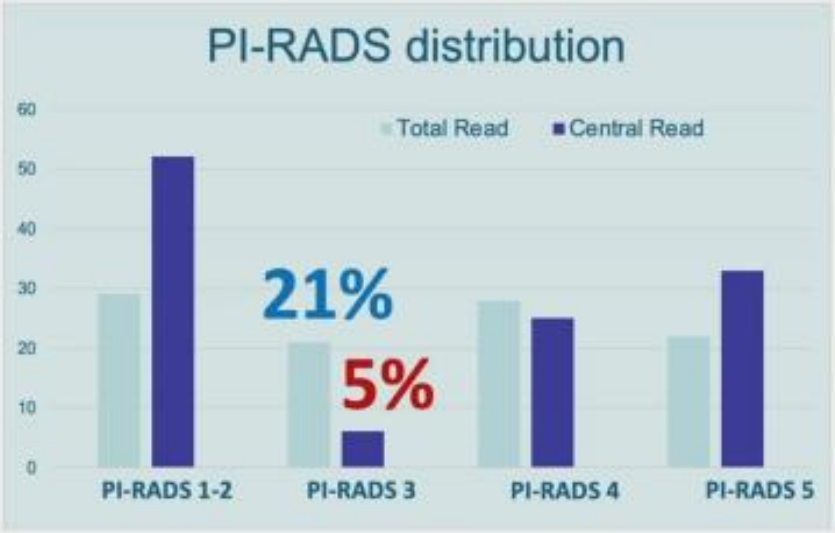

PZ
PI-RADS v2
TZ
DWI
ADC
T2w
1
2
3
4
5
Ø
Individual Decision
Biopsy
Schlemmer HP
Radiologie up2date 2017

# Transrectal vs Transperineal Biopsy Approaches




Chang DT, Challacombe B, Lawrentschuk N. Nat Rev Urol. 2013;10:690-702.

## Pitfall I – Reader experience




Kasivisvanathan NEJM 20128

ESOI Webinar 1, 01/31, 2019

HP Schlemmer, J. Radtke

European Radiology (2020) 30:5404–5416
https://doi.org/10.1007/s00330-020-06929-z

UROGENITAL

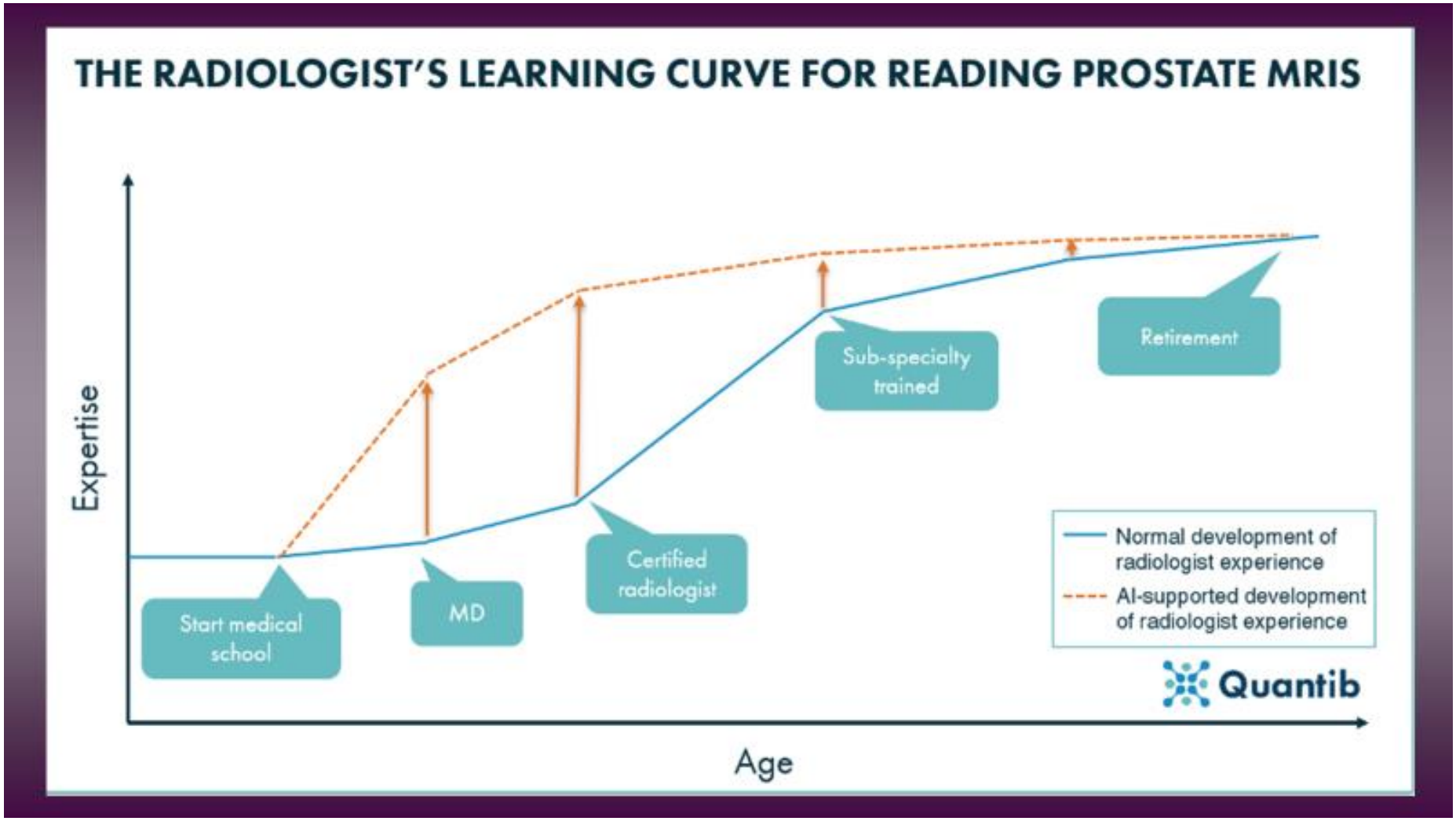
Check for updates

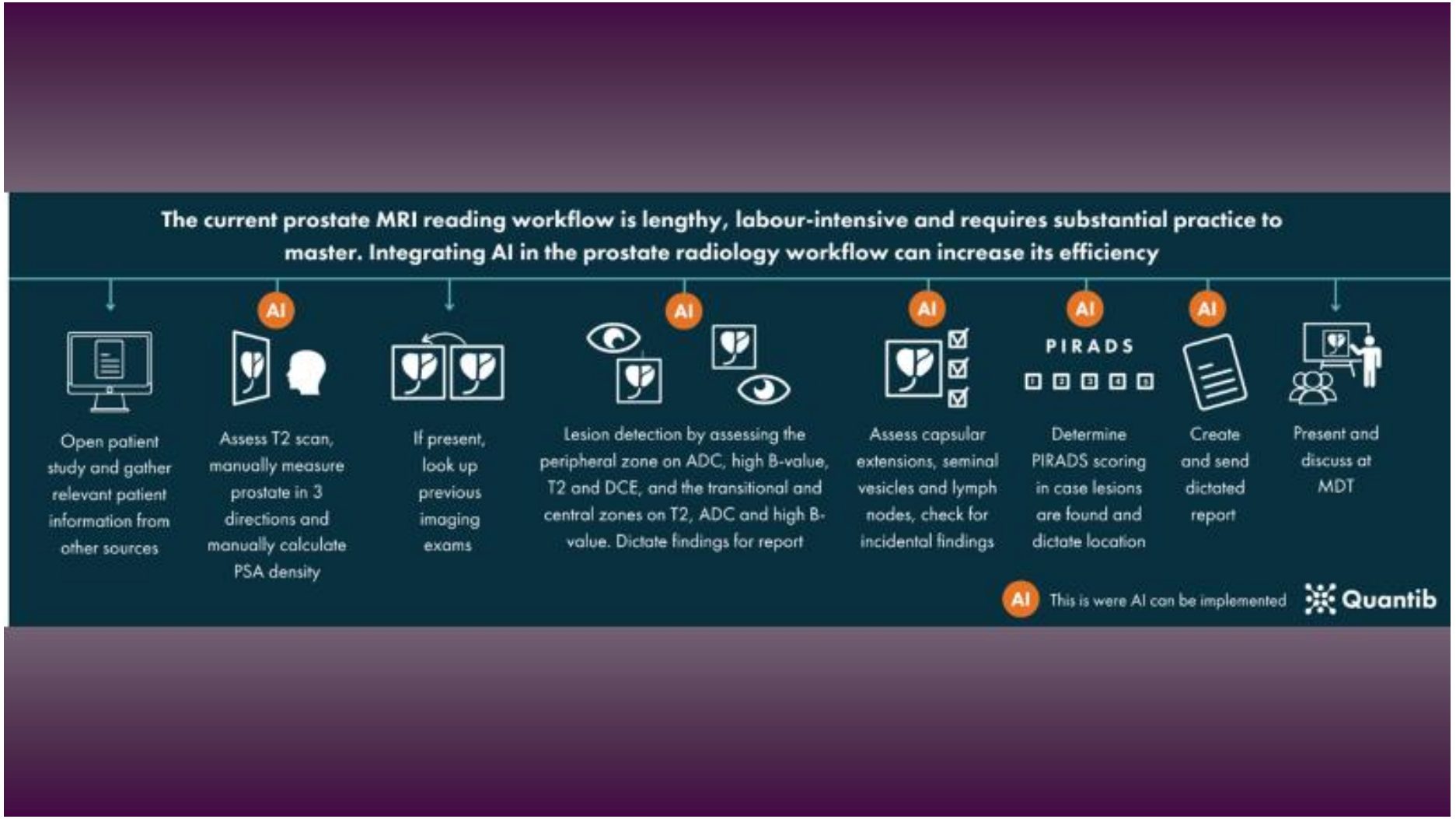
# ESUR/ESUI consensus statements on multi-parametric MRI for the detection of clinically significant prostate cancer: quality requirements for image acquisition, interpretation and radiologists' training

Maarten de Rooij[1] · Bas Israël[1,2] · Marcia Tummers[3] · Hashim U. Ahmed[4,5] · Tristan Barrett[6] · Francesco Giganti[7,8] · Bernd Hamm[9] · Vibeke Løgager[10] · Anwar Padhani[11] · Valeria Panebianco[12] · Philippe Puech[13] · Jonathan Richenberg[14] · Olivier Rouvière[15,16] · Georg Salomon[17] · Ivo Schoots[18,19] · Jeroen Veltman[20] · Geert Villeirs[21] · Jochen Walz[22] · Jelle O. Barentsz[1]

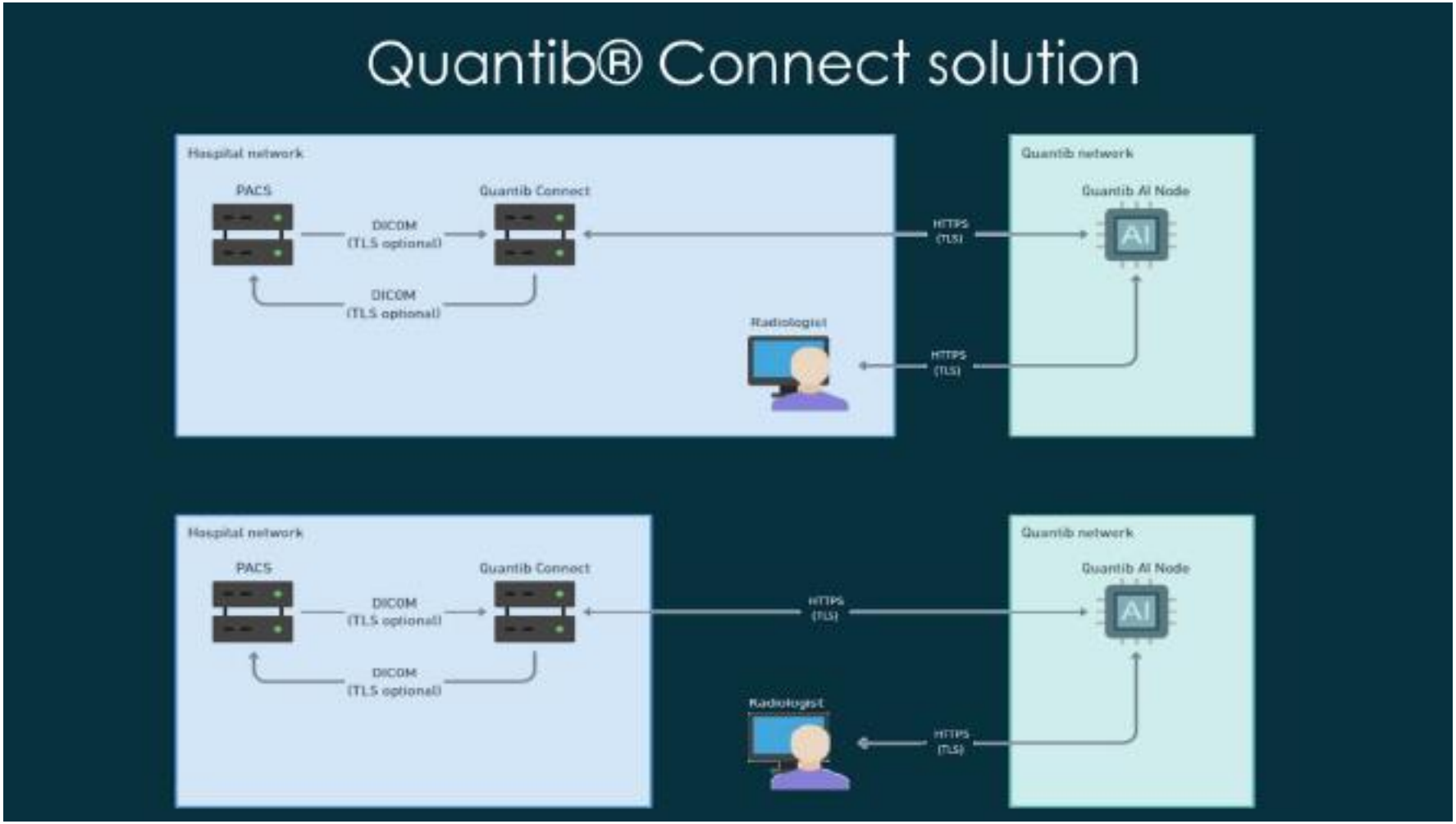
**Table 4** Consensus-based criteria 'basic' versus 'expert' radiologists. *N/A* not applicable

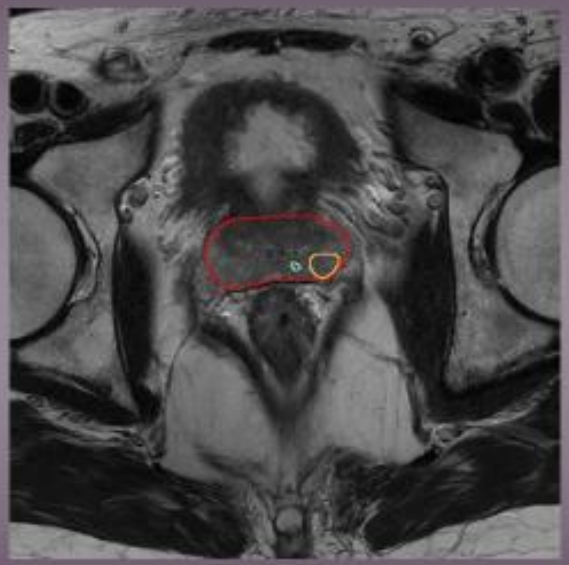
| Basic | Criterion | Expert |
|---|---|---|
| 100 | Minimum number of supervised cases before independent reporting | N/A |
| 400 | Minimum number of cases read | 1000 |
| 150 | Minimum number of cases/year | 200* |
| 1 | Examination interval (year(s)) | 4 |
| 80 | Agreement in double reads with expert centre (%) | ≥ 90 |

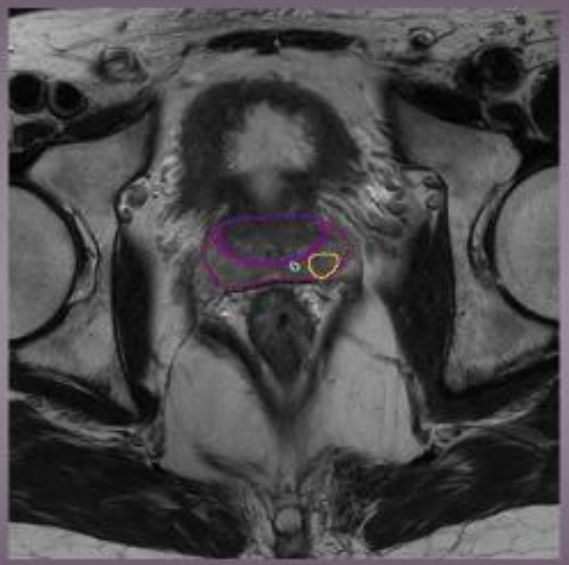

THE RADIOLOGIST'S LEARNING CURVE FOR READING PROSTATE MRIS
Expertise
Age
Start medical school
MD
Certified radiologist
Sub-specialty trained
Retirement
Normal development of radiologist experience
AI-supported development of radiologist experience
Quantib

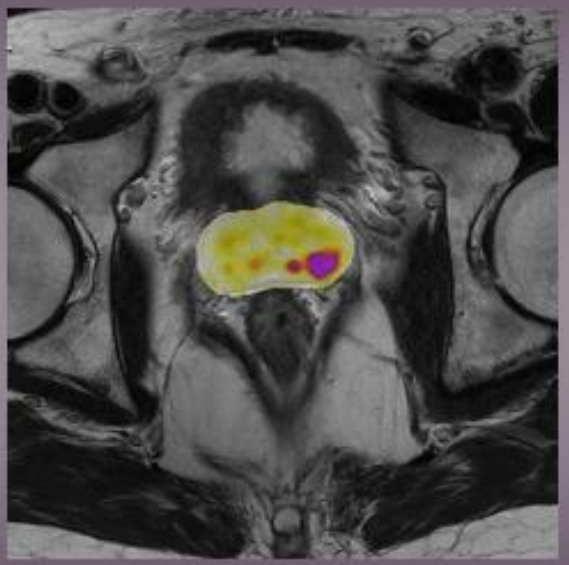

The current prostate MRI reading workflow is lengthy, labour-intensive and requires substantial practice to master. Integrating AI in the prostate radiology workflow can increase its efficiency
AI
AI
AI
AI
AI
PIRADS
Open patient study and gather relevant patient information from other sources
Assess T2 scan, manually measure prostate in 3 directions and manually calculate PSA density
If present, look up previous imaging exams
Lesion detection by assessing the peripheral zone on ADC, high B-value, T2 and DCE, and the transitional and central zones on T2, ADC and high B-value. Dictate findings for report
Assess capsular extensions, seminal vesicles and lymph nodes, check for incidental findings
Determine PIRADS scoring in case lesions are found and dictate location
Create and send dictated report
Present and discuss at MDT
AI This is were AI can be implemented
Quantib

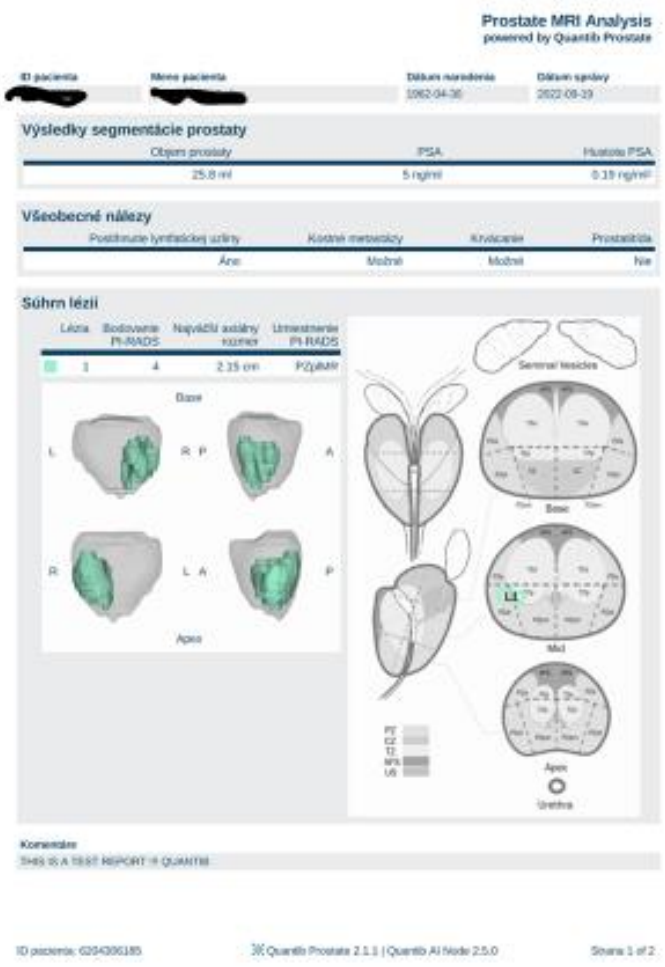
- Accelerated workflow
- Accurate quantification
- Elaborate reporting


Quantib® Connect solution
Hospital network
PACS
Quantib Connect
DICOM
(TLS optional)
DICOM
(TLS optional)
Radiologist
HTTPS
(TLS)
Quantib network
Quantib AI Node
AI
HTTPS
(TLS)
Hospital network
PACS
Quantib Connect
DICOM
(TLS optional)
DICOM
(TLS optional)
Radiologist
HTTPS
(TLS)
Quantib network
Quantib AI Node
AI
HTTPS
(TLS)









Prostate MRI Analysis
powered by Quantib Prostate

| ID pacienta | Meno pacienta | Dátum narodenia | Dátum správy |
|---|---|---|---|
| [redacted] | [redacted] | 1962-04-30 | 2022-09-19 |

**Výsledky segmentácie prostaty**

| Objem prostaty | PSA | Hustota PSA |
|---|---|---|
| 25.8 ml | 5 ng/ml | 0.19 ng/ml² |

**Všeobecné nálezy**

| Postihnutie lymfatickej uzliny | Kostné metastázy | Krvácanie | Prostatitída |
|---|---|---|---|
| Áno | Možné | Možné | Nie |

**Súhrn lézií**

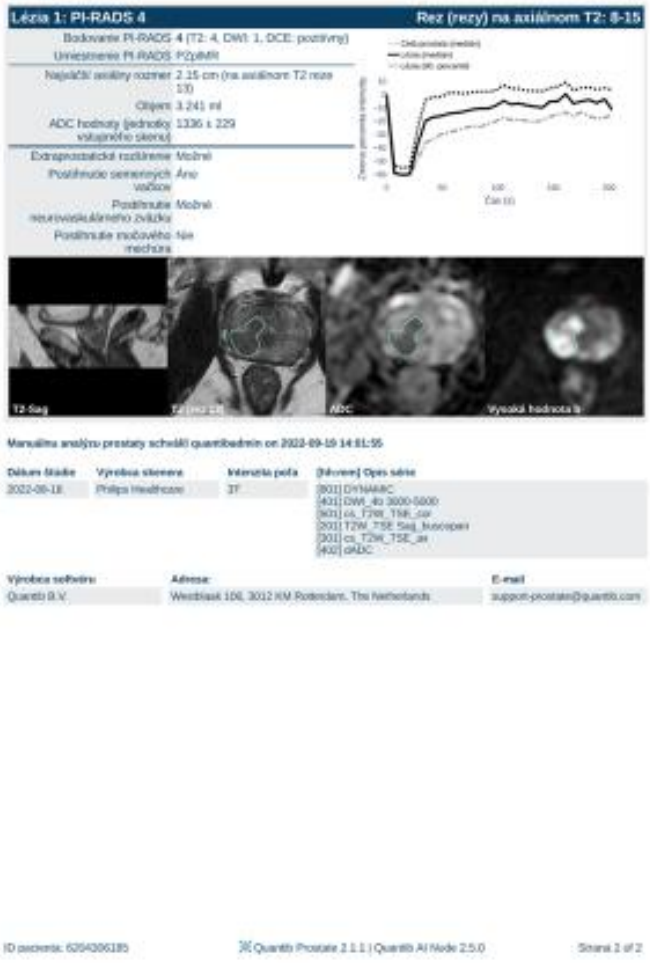
| Lézia | Bodovanie PI-RADS | Najväčší axiálny rozmer | Umiestnenie PI-RADS |
|---|---|---|---|
| 1 | 4 | 2.15 cm | PZ/pMR |

Base
L R P A
R L A P
Apex

Seminal Vesicles
Base
Mid
Apex
Urethra
PZ
TZ
AFS
US

Komentáre
THIS IS A TEST REPORT !!! QUANTIB





**Lézia 1: PI-RADS 4** — Rez (rezy) na axiálnom T2: 8-15

| | |
|---|---|
| Bodovanie PI-RADS | 4 (T2: 4, DWI: 1, DCE: pozitívny) |
| Umiestnenie PI-RADS | PZ/pMR |
| Najväčší axiálny rozmer | 2.15 cm (na axiálnom T2 rez 13) |
| Objem | 3.241 ml |
| ADC hodnoty (jednotky vizuálneho skenu) | 1336 ± 229 |
| Extraprostatické rozšírenie | Možné |
| Postihnutie semenných vačkov | Áno |
| Postihnutie neurovaskulárneho zväzku | Možné |
| Postihnutie močového mechúra | Nie |






Manuálna analýzu prostaty schválil quantibadmin on 2022-09-19 14:01:55

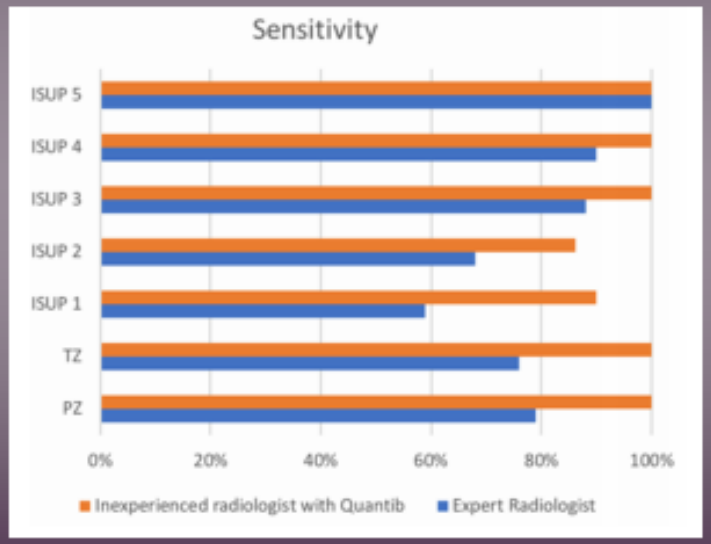
| Dátum štúdie | Výrobca skenera | Intenzita poľa | [Názvy] Opis série |
|---|---|---|---|
| 2022-08-18 | Philips Healthcare | 3T | [801] DYNAMIC<br>[401] DWI_40 3000-5000<br>[301] cs_T2W_TSE_cor<br>[201] T2W_TSE Sag_fluoropen<br>[201] cs_T2W_TSE_ax<br>[402] cADC |

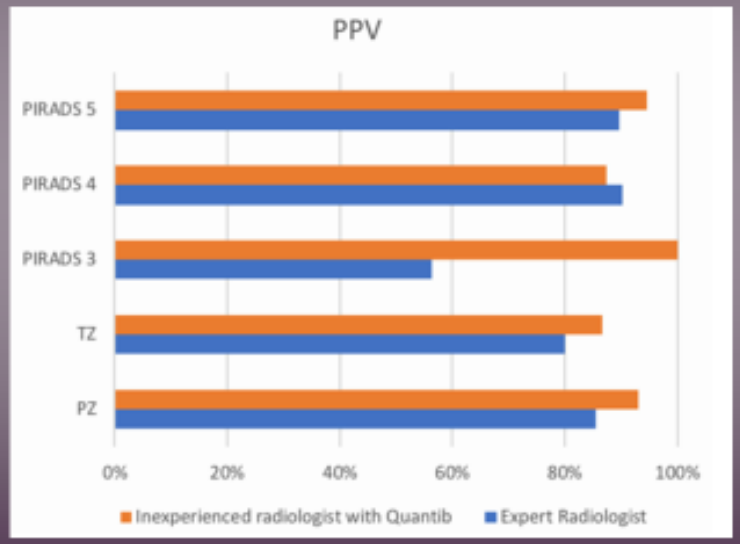
| Výrobca softvéru | Adresa | E-mail |
|---|---|---|
| Quantib B.V. | Westblaak 106, 3012 KM Rotterdam, The Netherlands | support-prostate@quantib.com |

*Article*

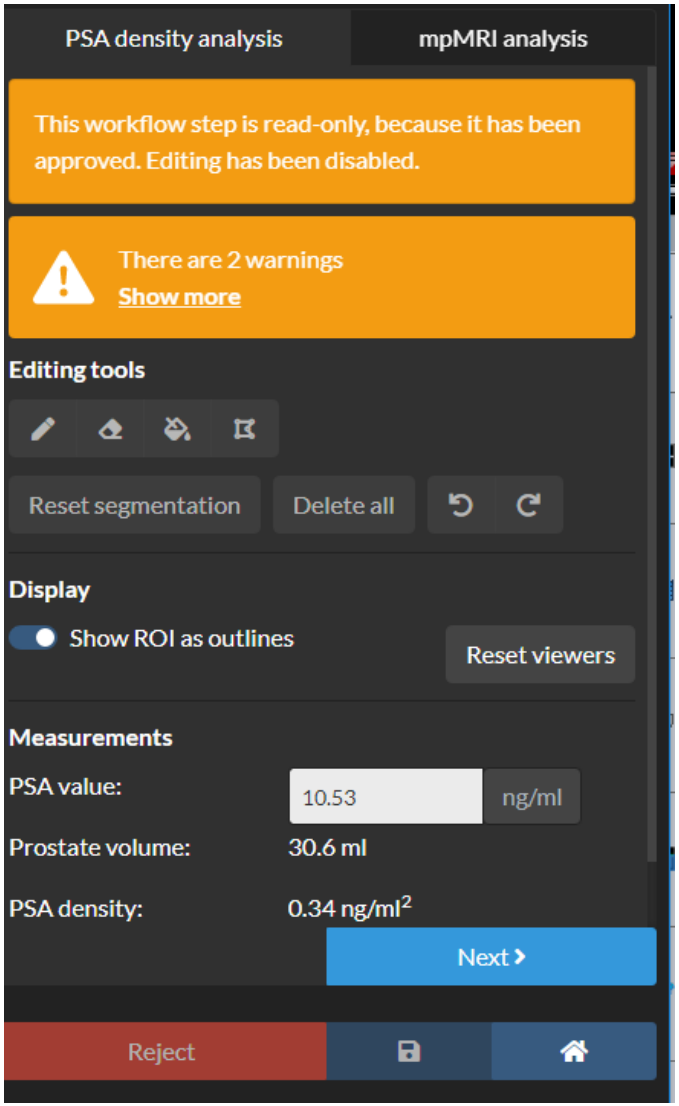
# Quantib Prostate Compared to an Expert Radiologist for the Diagnosis of Prostate Cancer on mpMRI: A Single-Center Preliminary Study

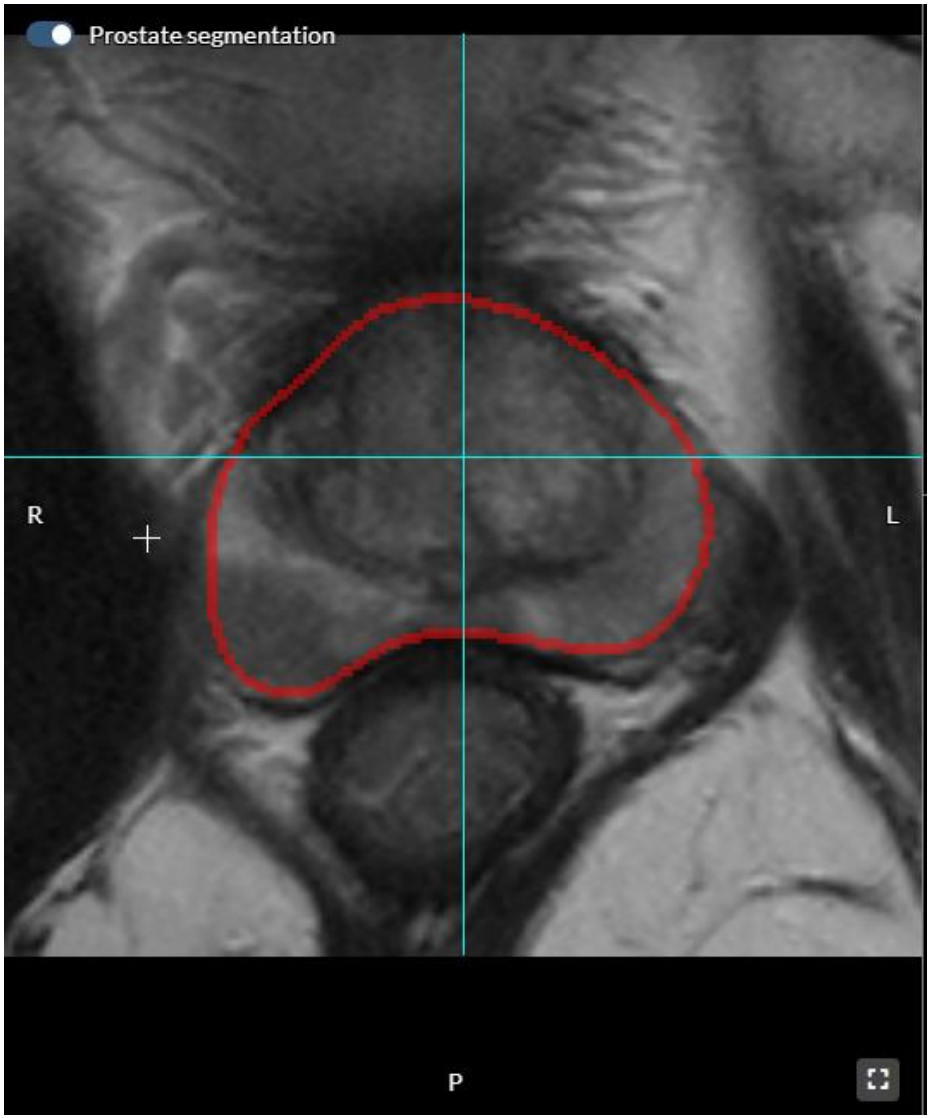
Eliodoro Faiella [1,2], Daniele Vertulli [1], Francesco Esperto [3], Ermanno Cordelli [4], Paolo Soda [4], Rosa Maria Muraca [2], Lorenzo Paolo Moramarco [2], Rosario Francesco Grasso [1], Bruno Beomonte Zobel [1] and Domiziana Santucci [1,2,4,*]

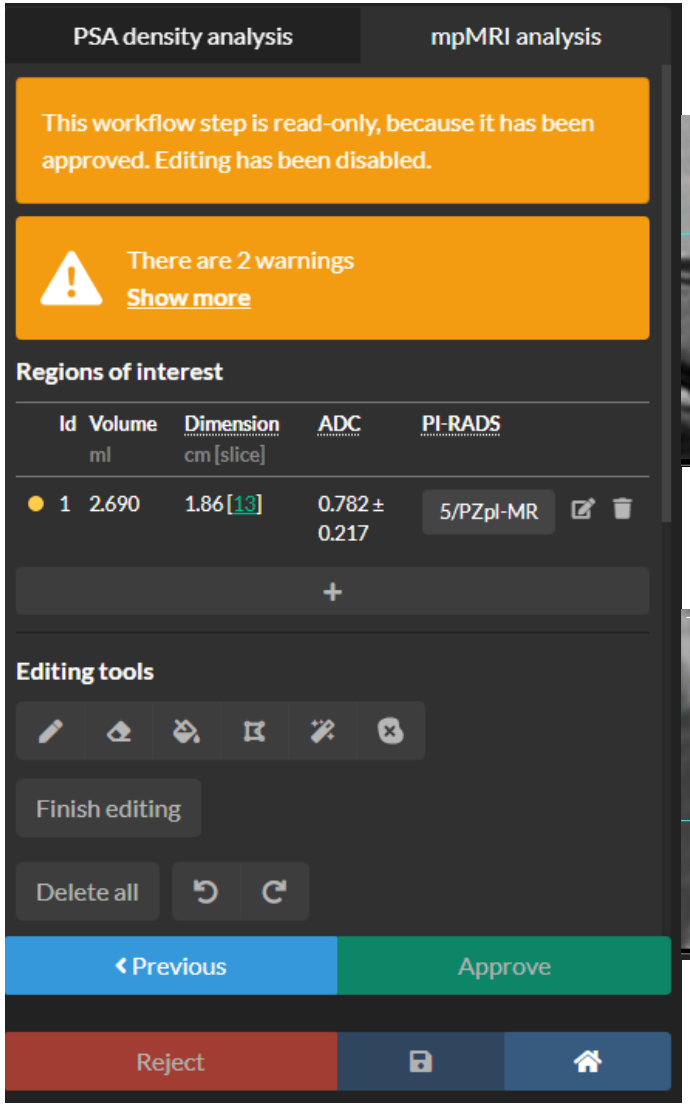


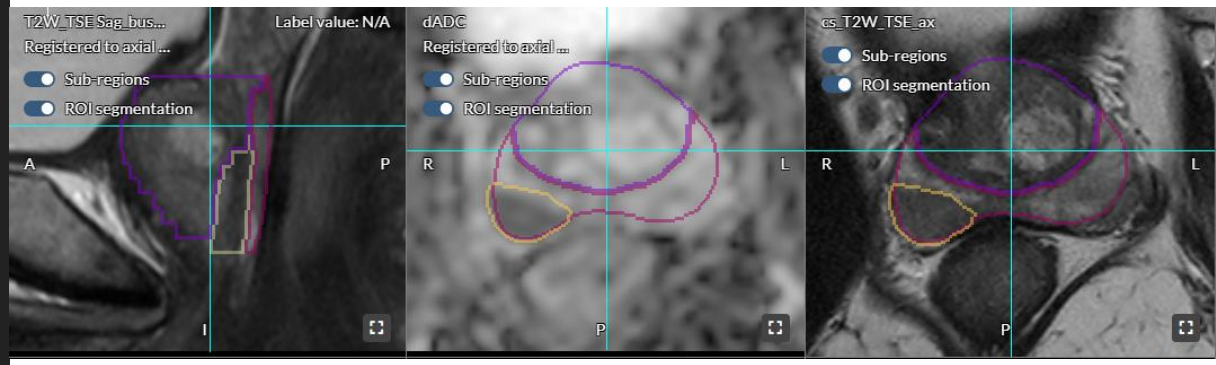



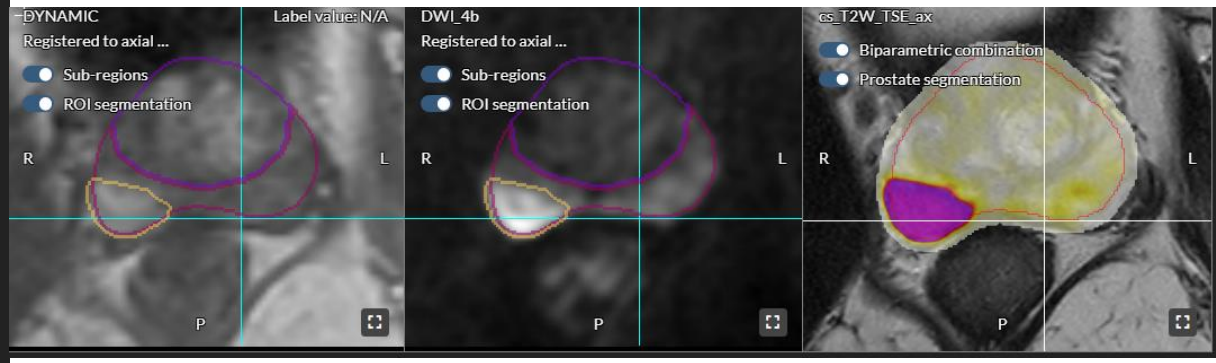

*Tomography* **2022**, *8*, 2010–2019. https://doi.org/10.3390/tomography8040168

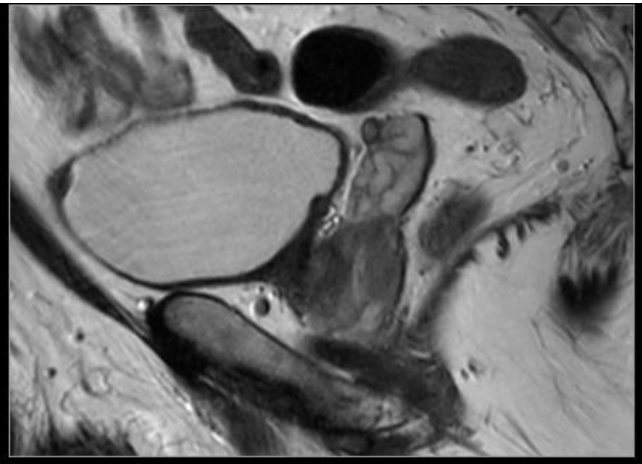
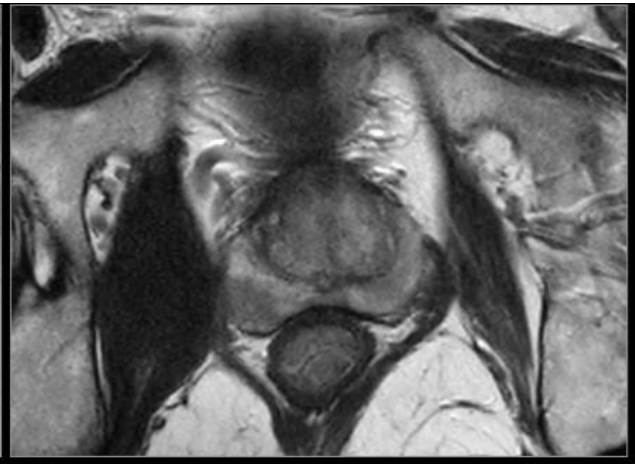

PSA density analysis
mpMRI analysis
This workflow step is read-only, because it has been approved. Editing has been disabled.
There are 2 warnings
Show more
Editing tools
Reset segmentation
Delete all
Display
Show ROI as outlines
Reset viewers
Measurements
PSA value:
10.53
ng/ml
Prostate volume:
30.6 ml
PSA density:
0.34 ng/ml²
Next ›
Reject

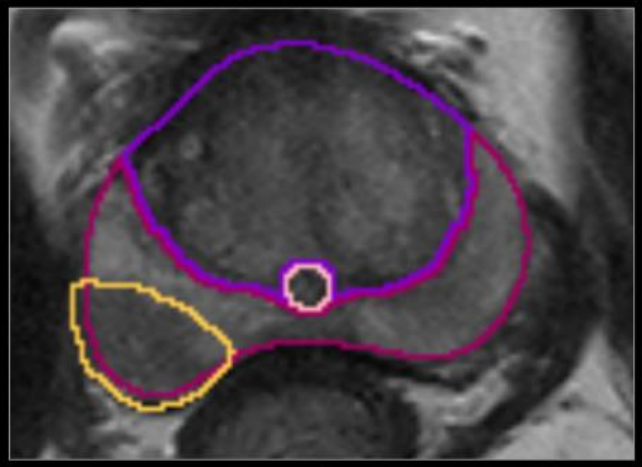
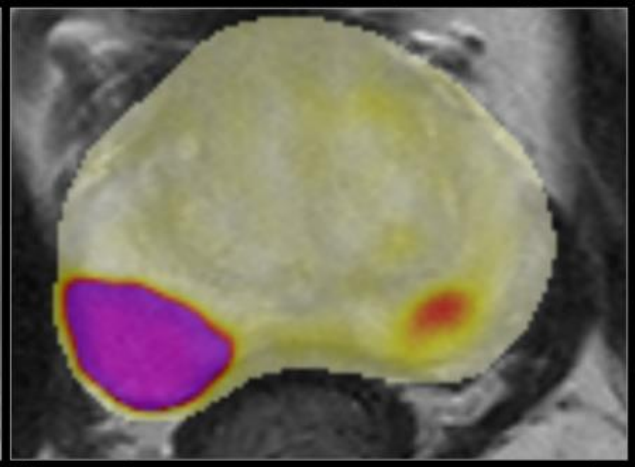
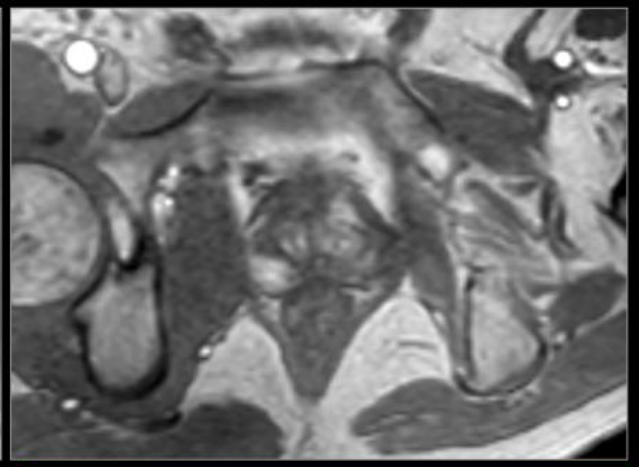
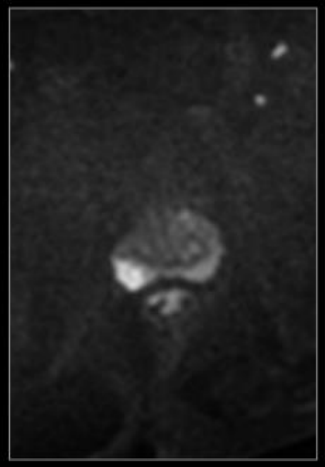
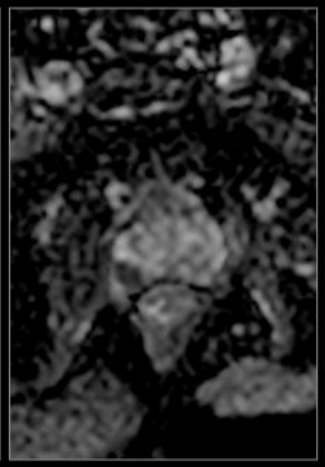
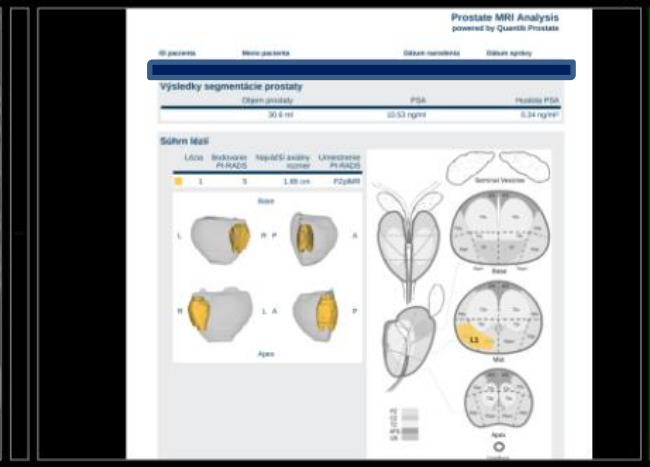
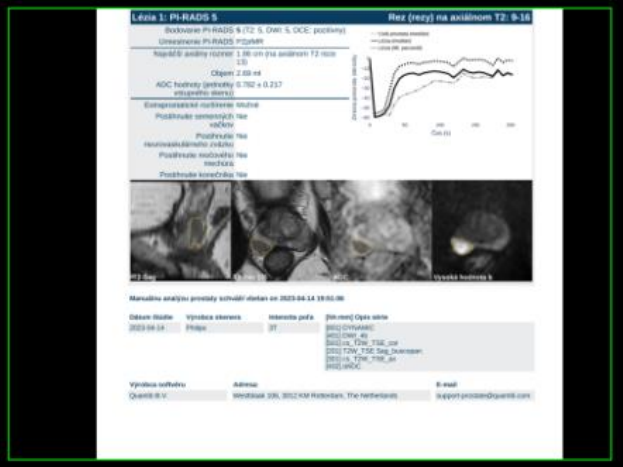

Prostate segmentation
R
L
P


PSA density analysis
mpMRI analysis
This workflow step is read-only, because it has been approved. Editing has been disabled.
There are 2 warnings
Show more
Regions of interest
Id Volume ml Dimension cm [slice] ADC PI-RADS
1 2.690 1.86 [13] 0.782 ± 0.217 5/PZpl-MR
Editing tools
Finish editing
Delete all
Previous
Approve
Reject


T2W_TSE Sag_bus...
Label value: N/A
Registered to axial ...
Sub-regions
ROI segmentation
dADC
cs_T2W_TSE_ax


DYNAMIC
Label value: N/A
Registered to axial ...
Sub-regions
ROI segmentation
DWI_4b
cs_T2W_TSE_ax
Biparametric combination
Prostate segmentation







Prostate MRI Analysis
powered by Quantib Prostate
Výsledky segmentácie prostaty
Súhrn lézií

Lézia 1: PI-RADS 5
Rez (rezy) na axiálnom T2: 9-16

S podporou AI umožňuje hodnotenie mpMR na expertnej úrovni

- Zrýchľuje ( zefektívňuje) hodnotenie
- Spresňuje a urýchľuje kvantifikáciu a hodnotenie
- Umožňuje efektívnu tvorbu štrukturovaného a štandardizovaného popisu