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DIAGNOSTIC PATHWAYS FOR PROSTATE CANCER IN ITALY: A COST-CONSEQUENCE ANALYSIS

Oleg Borisenko, MD, PhD,[1] Andrey Maslov, MD,[1] Agni Baka, MSc,[1] Lopamudra Das, PhD,[3] Maria Chiara Anelli,[2] Daniela Terracciano, PhD[4]

[1]MTRC HEOR, Leeds, UK; [2]Beckman Coulter SrL, Milan, Italy; [3]Beckman Coulter Diagnostics, Brea, USA; [4]Dept of Translational Medical Sciences, Federico II University, Naples, Italy.

BACKGROUND

- Prostate cancer (PCa) accounted for 23.2% of all new cancer cases (excluding non-melanoma skin cancers) diagnosed in men and for 9.9% of all deaths due to cancer in men in EU-27 countries in 2020[1]
- The total economic cost of prostate cancer in the EU was estimated at €8.43 billion in 2009[2]
- In 2006, 106–179 million euros (€) were dedicated to PCa management in the European countries exemplified by the UK, Germany, France, Italy, Spain, and the Netherlands with increasing cost expected due to earlier diagnosis and increasing survival[3]
- Research indicates that Prostate Health Index (*phi*) can be used alongside imaging technologies to increase diagnostic accuracy[4]

STUDY OBJECTIVES

This analysis aimed to determine the cost and clinical consequences of different diagnostic strategies, including multiparametric magnetic resonance imaging (mpMRI) and *phi* test for diagnosing PCa in Italy.

METHODS

A decision analytic model using a decision tree was developed. The decision tree was validated using 12 subject matter experts representing clinical laboratories, radiology, urology, and oncology.

Model details:

- The population included men with PSA >2 and <10 and suspicious or negative digital rectal examination
- Hypothetical cohort of 100 individuals
- Four diagnostic strategies were considered:
  1. mpMRI alone
  2. mpMRI followed by phi
  3. *phi* followed by mpMRI and
  4. *phi* alone
- Two cut-offs for *phi*, 25 and 28, were considered
- The analysis was performed from the perspective of Italian healthcare payers
- Positive results of mpMRI or *phi* were confirmed by prostate biopsy
- Outcomes included the numbers of diagnosed and missed overall PCa and clinically significant PCa (csPCa, Gleason Grade ≥7)
- Prevalence data and operational characteristics of diagnostic methods were obtained from clinical literature
- Direct cost information was obtained from national Italian sources
- Deterministic (DSA), probabilistic sensitivity (PSA, 5000 Monte-Carlo simulations), and scenario analyses were performed
- The following parameters were changed in the DSA: PCa prevalence, frequency of post-biopsy, physician visits, hospital admissions due to biopsy-related complications, and all unit cost inputs
- Analysis was limited to the diagnostic phase of the patient pathway. Further diagnostics and treatment of PCa were not considered.

MODEL STRUCTURE AND INPUTS

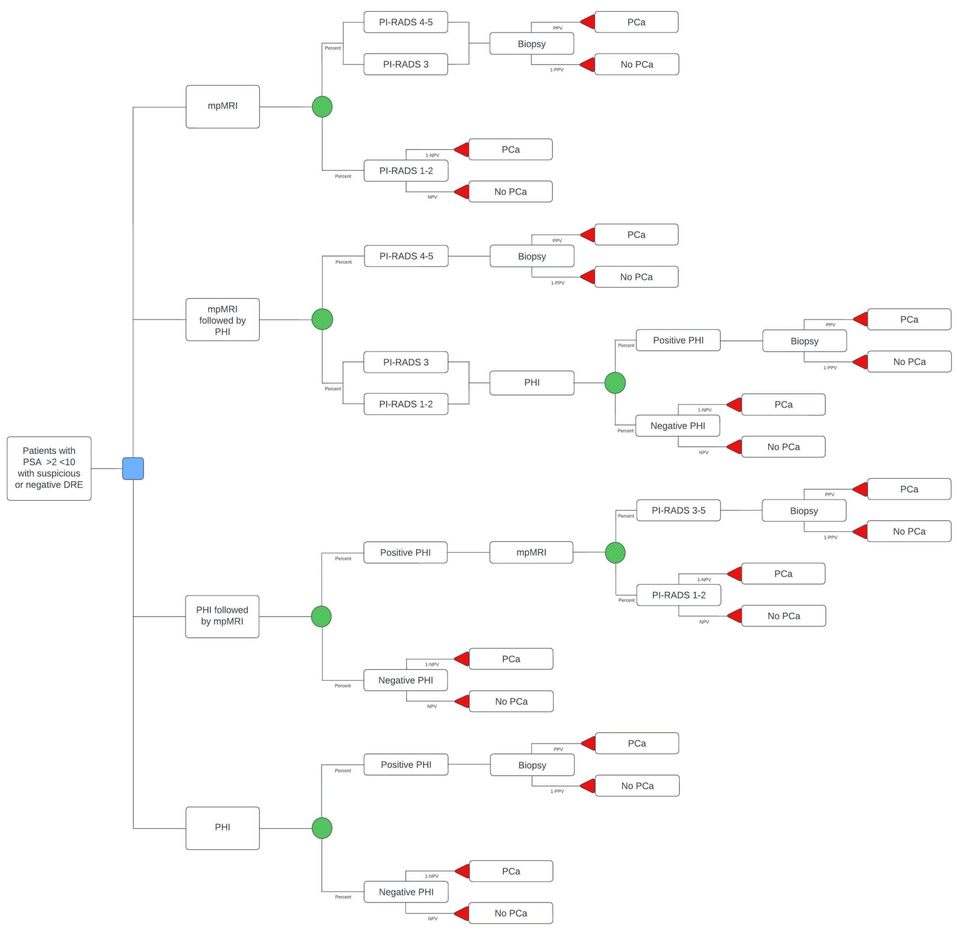

Figure 1. illustrates the decision tree with 4 diagnostic strategies: mpMRI only, mpMRI followed by *phi*, *phi* followed by mpMRI, *phi* only

Clinical Inputs

Input	Sensitivity	Specificity	Source
phi			
25.00	PCa 0.88 csPCa 0.914	PCa 0.336	[5]
28.00	PCa 0.80 csPCa 0.914	PCa 0.451	
mpMRI			
PIRADS 4	PCa 0.701 csPCa 0.890	PCa 0.797	[6]
PIRADS 3	PCa 0.757 csPCa 0.932	PCa 0.726	

Resource Utilization Inputs

Input	Value	Source
Frequency of unplanned physician visits due to biopsy-related complications	2.5%	[7]
Frequency of unplanned hospitalizations due to biopsy-related complications	0.9%	
Percentage of hospitalization due to urinary infection	71.6%	[8]
Percentage of hospitalization due to urinary bleeding	19.4%	
Percentage of hospitalization due to urinary obstruction	9%	

Cost Inputs

Input	Value	Source
phi test	€50	ICD-9-CM code 90.56.5 (Antigene prostatico specific, PSA) 3 times, plus an additional fee for *phi* test
mpMRI (prostate region)	€187.13	ICD-9-CM code 88.95.5 (Risonanza magnetica nucleare (RM) dell'addome inferiore e scavo pelvico, senza e con contrasto)
Physician visit due to biopsy-related complications	€16.2	ICD-9-CM code 89.01 (Anamnesi e valutazione, definite brevi)
TRUS-guided biopsy	€94.9	ICD-9-CM code 60.11.1 (Biopsia transperineale [percutanea] [agobiopsia] della prostata)
Histopathology evaluation	€136.9	ICD-9-CM code 91.44.1 (Esame istocitopatologico apparato urogenitale: Agobiopsia prostatica)
Hospitalization due to urinary infection	€1,883	DRG code 321 (Infezioni del rene e delle vie urinarie, età > 17 anni senza CC)
Hospitalization due to urinary bleeding	€1,075	DRG code 326 (Segni e sintomi relativi a rene e vie urinarie, età > 17 anni senza CC)
Hospitalization due to urinary obstruction	€1,008	DRG code 332 (Altre diagnosi relative a rene e vie urinarie, età > 17 anni senza CC)

RESULTS

Base Case Results

Arm	Total cost	Total biopsies	Unnecessary biopsies	All PCa cases identified	PCa cases missed	csPCa cases identified	csPCa cases missed
phi Cut-off 25							
mp-MRI	€ 31,206	51	14	36	12	18	1
mp-MRI f/u *phi*	€ 42,338	84	38	46	2	19	0
phi f/u mp-MRI	€ 29,599	41	9	32	16	16	3
phi	€ 23,964	77	35	42	6	18	2
phi Cut-off 28							
mp-MRI	€ 31,206	51	14	36	12	18	1
mp-MRI f/u *phi*	€ 40,877	78	33	45	3	19	0
phi f/u mp-MRI	€ 26,639	37	8	29	19	16	3
phi	€ 21,538	67	29	38	10	18	2

- At both cut-off points, the strategy mpMRI followed by *phi* (2), unlike other strategies, did not miss any single case of csPCa per 100 population but also had increased cost
- The "*phi* stand-alone" (4) strategy was associated with lower costs and higher benefits in terms of PCa cases identified compared to the "mpMRI stand-alone" strategy, meaning that the "*phi* stand-alone" strategy is dominant over the "mpMRI stand-alone" strategy. However, there were no benefits in the number of identified csPCa cases.

SENSITIVITY ANALYSIS

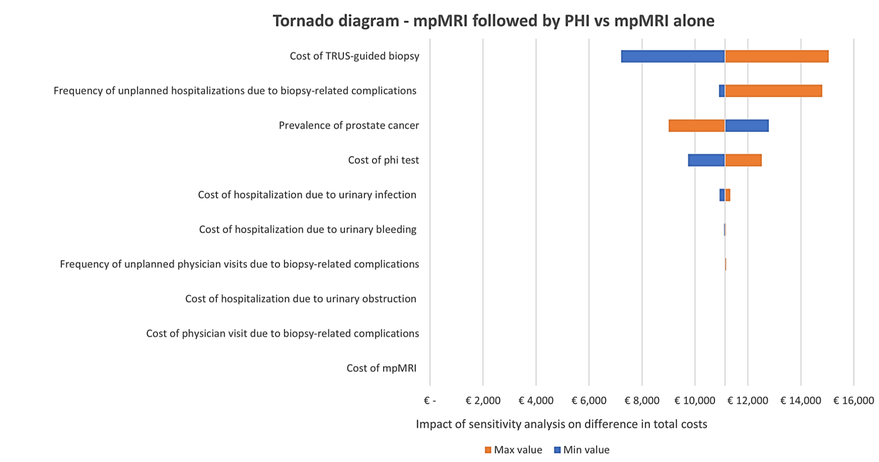

Figure 2. illustrates the one-way sensitivity for mpMRI f/ *phi* (cutoff 25) vs. mpMRI

Probabilistic Sensitivity Analysis

Strategy (vs. mpMRI alone)	Average Total Cost	Std. Dev	95%CI (Low, High)	Base Case Total Cost
phi	€ 11,119	€ 984	€ 11,091 - € 11,146	€ 11,132
mpMRI f/ *phi*	€ -1,620	€ 831	€ -1,643 - € -1,597	€ -1,606
phi f/u mpMRI	€ -7,201	€ 2,380	€ -7,267 - € -7,135	€ -7,242

- The difference in total costs between the "mpMRI followed by *phi*" and the "mpMRI" strategies was sensitive to the cost of biopsy, the frequency of hospitalizations due to complications, prevalence of PCa, and the cost of *phi* test (see Figure 2)
- The PSA indicated moderate variation between the base case and probabilistic average total costs for all diagnostic strategies in comparison with the "mpMRI stand-alone" strategy

STUDY LIMITATIONS

- Modeling study might not represent real-world clinical practice
- The heterogeneity in patient populations described in different publications used as input sources could affect the results
- Study assumed 100% diagnostic accuracy for biopsy which might not be accurate in the real world
- Simulation does not include other potential comparators of *phi*

CONCLUSION

- A PCa diagnostic strategy of mpMRI followed by *phi* provides the most significant clinical benefit but is associated with the highest cost in the Italian healthcare system
- The use of *phi* alone could have significant economic value but should be balanced against clinical judgement
- Additional research is needed to confirm the benefits in a real-world setting

References

1. Dyba T, Randi G, Bray F, et al. The European cancer burden in 2020: Incidence and mortality estimates for 40 countries and 25 major cancers. Eur J Cancer. 2021;157:308-347. doi:10.1016/j.ejca.2021.07.039
2. Luengo-Fernandez R, Leal J, Gray A, Sullivan R. Economic burden of cancer across the European Union: a population-based cost analysis. Lancet Oncol. 2013;14(12):1165-1174. doi:10.1016/S1470-2045(13)70442-X
3. Roehrborn CG, Black LK. The economic burden of prostate cancer. BJU Int. 2011;108(6):806-813. doi:10.1111/j.1464-410X.2011.10365.x
4. Ferro M, Crocetto F, Bruzzese D, et al. Prostate health index and multiparametric MRI: partners in crime fighting overdiagnosis and overtreatment in prostate cancer. Cancers (Basel). 2021;13(18). doi:10.3390/cancers13184723
5. FDA. PMA P090026: FDA Summary of Safety and Effectiveness Data. 2012
6. van der Leest, Marloes et al. "Head-to-head Comparison of Transrectal Ultrasound-guided Prostate Biopsy Versus Multiparametric Prostate Resonance Imaging with Subsequent Magnetic Resonance-guided Biopsy in Biopsy-naïve Men with Elevated Prostate-specific Antigen: A Large Prospective Multicenter Clinical Study." European urology vol. 75,4 (2019): 570-578. doi:10.1016/j.eururo.2018.11.023
7. Tulone, G.; Giannone, S.; Mannone, P. et al. Comparison of Fluoroquinolones and Other Antibiotic Prophylaxis Regimens for Preventing Complications in Patients Undergoing Transrectal Prostate Biopsy. Antibiotics 2022, 11, 415.
8. Nicholson A, Mahon J, Boland A, et al. The clinical effectiveness and cost-effectiveness of the PROGENSA® prostate cancer antigen 3 assay and the Prostate Health Index in the diagnosis of prostate cancer: a systematic review and economic evaluation. Health Technol Assess 2015;19(87).

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