Artificial intelligence-assisted creation of clinical decision tools in advanced prostate cancer

Rohit Malyala[1], Hanmu Yan[2], Nathan Wong[1]
[1]Department of Urologic Sciences, University of British Columbia, Vancouver BC, Canada; [2]Department of Surgery, St. Joseph's Health Centre, University of Toronto, Toronto ON, Canada

Cite as: Malyala R, Yan H, Wong N. Artificial intelligence-assisted creation of clinical decision tools in advanced prostate cancer. *Can Urol Assoc J* 2026 August 20; Epub ahead of print. http://dx.doi.org/10.5489/cuaj.9625

Published online August 20, 2026

Corresponding author: Dr. Nathan Wong, Department of Urologic Sciences, University of British Columbia, Vancouver BC, Canada; nathan.wong@medportal.ca

***

Every passing year seems to mark yet another paradigm shift in the landscape of advanced prostate cancer (PCa). Rapid evolution in advanced PCa treatment has been especially spurred by the introduction of novel androgen receptor pathway inhibitors (ARPIs); abiraterone, enzalutamide, apalutamide, and darolutamide have sequentially entered the disease space, with their indications continually expanding to earlier stages in the disease course [1-3].

The delivery of these medications, previously limited to medical oncologists, has gradually come under the purview of urologists. A shared understanding of ARPI management and side effects has become more commonplace, and everyday urologists are now increasingly capable of administering these medications. However, although numerous phase 3 randomized controlled trials have firmly established ARPI intensification as standard-of-care, its use in metastatic prostate cancer in Canada currently lags, ranging from 29% to 62%, highlighting a space for improvement [4,5].

ARPI selection is highly personalizable. Urologists more well-versed in the literature may find selection straightforward, but many–including learners–may benefit from additional support for treatment selection, including assistance from clinical pharmacists or medical oncologists. For example, darolutamide may be preferred for patients with a history of seizures due to its lower penetration of the blood-brain barrier; abiraterone requires careful management of its steroid component in patients with conditions such as diabetes and osteoporosis; and enzalutamide carries a risk of seizures, fatigue, and falls, making its use unfavorable in frail elderly patients or those with seizure disorders [6,7]. As the array of therapeutic options expands, the clinical challenge has shifted from identifying effective treatments, to selecting the right treatment, for the right patient, at the right time.

The advent of artificial intelligence (AI) holds promise in coherently synthesizing the multiple patient and drug factors in ARPI decision-making [8]. AI-generated clinical decision support tools in particular can rapidly create standardized complex clinical decision frameworks by integrating patient and provider factors with the latest evidence and guidelines. However, concerns abound regarding hallucination, opacity of reasoning, and variability in outputs from generative AI models, particularly in high-stakes clinical environments where reproducibility, transparency, and accountability are essential [9]. These limitations have tempered enthusiasm for fully autonomous AI decision-making in oncology and underscore the need for approaches that harness AI's strengths without relinquishing clinical control.

Accordingly, we propose a strategy where AI is used to draft highly verifiable clinical pathways that are explicitly designed for review, refinement, and validation by subject matter experts. In this work we showcase TranslationalAI: Partner in Practice (translational.ca/pip) [10]; a clinical decision support tool that can guide users in the landscape of advanced prostate cancer, from non-metastatic castrate-naive to metastatic castrate-resistant settings. To create this tool, advanced commercially available large language models (LLMs) were provided with sections of relevant clinical guidelines, and prompted to apply a structured JSON (JavaScript Object Notation) schema to encode provided clinical guidelines into structured logic pathways.

These structured logic pathways are translated into a web application that systematically queries the user on three key patient domains. The process starts with establishing the disease stage and prior therapies to confirm the appropriate evidence base. Next, patient factors are rigorously assessed, focusing on contraindications and cautions related to ARPIs, such as the patient's performance status, chemotherapy fitness, cardiovascular risk, history of seizures or falls risk, and financial capacity. Finally, provider and practical factors are evaluated, incorporating the need for side-effect monitoring and an automated assessment of DDIs, which is essential given the complex metabolic pathways of ARPIs. By integrating these three domains, the tool processes complex data to yield a clear, tiered recommendation including "Treatment Selection (Recommended)", "Medications to Use with Caution", and "Those Not Recommended", thereby translating conditional guidelines into an immediate, usable clinical action plan (Figure 1). The tool is designed for community urologists, residents, fellows, who may not be sub-specialized in advanced prostate cancer, and as such, explanations are provided after web-app recommendations.

Regarding validity, before web deployment, the flowchart pathways at each logic node were manually vetted by two urologic oncologists. In the current iteration of the ARPI selection tool, manual revision was rarely required for logic encoding for well-structured guidelines, but frequently took place in areas of clinical nuance or evidence-free zones, where the application of expert consensus or first-principles was required. Ultimately, the final tool is entirely rules-based and deterministic. This approach to tool creation combines the speed of AI-assisted pathway generation with the reliability of explicit IF-THEN logic, creating a system that is transparent and auditable. A conventional LLM chatbot may generate different answers each time; this approach applies clinical reasoning consistently, potentially improving suitability for eventual real-world clinical use. Python unit tests were run with simulated patient profiles (e.g., "mCSPC patient with seizure history") to verify that the engine consistently outputs the correct safety warnings or exclusions.

At translational.ca/pip, clinical pathway modules are developed not only for ARPI selection, but for several other domains within and outside urologic oncology, from side-effect management in ADT, to recurrent UTI management. The website is available for public review but at this stage is for educational purposes exclusively, and does not substitute for professional medical advice, diagnosis, or treatment. Modules are reviewed semi-annually or upon the release of new major urological society guidelines.

We are hopeful that the creation and adoption of these tools, after appropriate validation in clinical settings, will expand the capabilities of, and reduce the cognitive burden of the everyday urologist. Preliminary review by local residents and community staff at our site has been positive. Users indicate that these tools could have a role in improving provider efficiency by reducing the time spent cross-referencing complex drug-drug interactions databases and guidelines, and help elevate the quality of care by offering accessible, evidence-based guidance that ensures adherence to current standards. The tool in its current form is not formally validated externally however, and is not intended to replace clinical judgment, but to support it, serving an educational role with verifiable structured insights, making high-quality patient care more consistent. We are hopeful that AI-assisted strategies such as this, with thoughtful deployment and staunch physician oversight, will play a useful role in the provision of excellent clinical care.

REFERENCES

1. James ND, de Bono JS, Spears MR, et al. Abiraterone for prostate cancer not previously treated with hormone therapy. *N Engl J Med* 2017;377:338-51. https://doi.org/10.1056/NEJMoa1702900
2. Sumanasuriya S, De Bono J. Treatment of advanced prostate cancer - A review of current therapies and future promise. *Cold Spring Harb Perspect Med* 2018;8:a030635. https://doi.org/10.1101/cshperspect.a030635
3. Raychaudhuri R, Lin DW, Montgomery RB. Prostate cancer: A review. *JAMA* 2025;333:1433-46. https://doi.org/10.1001/jama.2025.0228
4. Nguyen DD, Satkunasivam R, Aminoltejari K, et al. Association of patient and physician characteristics with androgen-deprivation-therapy intensification in patients with de novo hormone-sensitive metastatic prostate cancer: A population-based study. *Cancer* 2025;131:e70070. https://doi.org/10.1002/cncr.70070
5. Yip S, Niazi T, Hotte SJ, et al. Evolving real-world patterns of practice in metastatic castration-sensitive prostate cancer (mCSPC): The genitourinary research consortium (GURC) national multicenter cohort study. *J Clin Oncol* 2022;30:86. https://doi.org/10.1200/JCO.2022.40.6_suppl.086
6. Lowrance W, Dreicer R, Jarrard DF, et al. Updates to advanced prostate cancer: AUA/SUO guideline (2023). *J Urol* 2023;209:1082-90. https://doi.org/10.1097/JU.0000000000003452
7. Garje R, Riaz IB, Naqvi SA, et al. Systemic therapy in patients with metastatic castration-resistant prostate cancer: ASCO guideline update. *J Clin Oncol* 2025;43:2311-34. https://doi.org/10.1200/JCO-25-00007
8. Zhai G, Bar M, Cowan A, et al. AI for evidence-based treatment recommendation in oncology: A blinded evaluation of large language models and agentic workflows. *Front Artif Intell* 2025;8:1683322. https://doi.org/10.3389/frai.2025.1683322
9. Hantel A, Walsh TP, Marron JM, et al. Perspectives of oncologists on the ethical implications of using artificial intelligence for cancer care. *JAMA Netw Open* 2024;7:e244077. https://doi.org/10.1001/jamanetworkopen.2024.4077
10. translational.ca. TranslationalAI: Partner in practice. Available at: https://translational.ca/pip (accessed December 30, 2025)

Disclosures: Dr. Yan is the primary developer and owner of TranslationalAI and its associated software tools involving other uses of AI tools in clinical spaces. There is currently no commercial intent for the holdings of TranslationalAI or the Partner-in-Practice toolkit.

FIGURES AND TABLES

Figure 1. Exemplar screenshots of the ARPI selection clinical decision tool. The disease stage and overall clinical status of the patient are established first. These are followed by relevant refining questions on other patient factors, from medications, to past medical history of seizures, skin disorders, and more. At the end of the flowchart, recommendations are stratified into tiers encompassing "Recommended," "Use with caution," and "Not recommended." Dropdowns ("show details") are available at each tier and provide information on relevant evidence backing each suggestion and which elements of the flowchart contributed to the tier placement of the particular medication.