

Factors underlying treatment decision-making for localized prostate cancer in the U.S. and Canada: A scoping review using principal component analysis

Mustafa Andkhoie, MPH; Desneige Meyer, MPH; Michael Szafron, PhD

School of Public Health, University of Saskatchewan, Saskatoon, SK, Canada

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Abstract

Introduction: The purpose of this research is to gather, collate, and identify key factors commonly studied in localized prostate cancer (LPC) treatment decision-making in Canada and the U.S.

Methods: This scoping review uses five databases (Medline, EMBASE, CINAHL, AMED, and PsycInfo) to identify relevant articles using a list of inclusion and exclusion criteria applied by two reviewers. A list of topics describing the themes of the articles was extracted and key factors were identified using principal component analysis (PCA). A word cloud of titles and abstracts of the relevant articles was created to identify complementary results to the PCA.

Results: This review identified 77 relevant articles describing 32 topics related to LPC treatment decision-making. The PCA grouped these 32 topics into five key factors commonly studied in LPC treatment decision-making: 1) treatment type; 2) socioeconomic/demographic characteristics; 3) personal reasons for treatment choice; 4) psychology of treatment decision experience; and 5) level of involvement in the decision-making process. The word cloud identified common phrases that were complementary to the factors identified through the PCA.

Conclusions: This research identifies several possible factors impacting LPC treatment decision-making. Further research needs to be completed to determine the impact that these factors have in the LPC treatment decision-making experience.

Introduction

Prostate cancer is one of the most commonly diagnosed invasive cancers in Canada and the United States (US).¹⁻⁴ Localized prostate cancer (LPC), i.e. cancer contained within the prostate gland, accounts for about 79% of all prostate cancers diagnosed in North America.¹ The progression of LPC to the metastatic stage has a substantial negative impact on the relative survival of the patients (the five-year relative survival decreases from 100% to 30%).¹ Therefore, the monitoring of the disease and undergoing necessary treatment(s) are important to prevent metastasis.

The most common treatment types for LPC are active surveillance or watchful waiting (AS/WW), radiation therapy, surgery (prostatectomy), and hormonal therapy.⁵ Each treatment has different side effects (including incontinence and erectile dysfunction), impacting the quality-of-life for patients and their families.⁶⁻⁸ Therefore, it is necessary for physicians to make sure treatment choices align with patient needs and preferences. Studies on treatment decision-making focus on specific patient profiles, for example, ethnic and racial minorities, different age groups, and specific treatment types.⁹⁻¹⁶ While there is research describing treatment decision-making for varying LPC patient profiles, there is no literature comprehensively identifying common factors underlying treatment decision-making.

The purpose of this research is to gather, collate and identify key factors commonly studied in LPC treatment decision-making in Canada and the United States.

Methods

Following the scoping review process of Arksey and O’Malley, we reviewed the literature to identify key factors for LPC treatment decision-making in Canada and the United States.¹⁷ The following steps were taken to compile the list of relevant articles:

1. One of the reviewers compiled the list of references from five databases (Medline, EMBASE, CINAHL, AMED and PsycInfo) using the search terms listed in Table 1.
2. The same reviewer from step 1 removed the duplicates in the list of references.
3. The same reviewer from step 1 removed references outside the inclusion countries/timeframes and references that were not full-text peer-reviewed articles, and compiled a list of peer-reviewed articles.
4. Two reviewers independently applied the inclusion/exclusion criteria listed in Table 2 to the titles and abstracts of the peer-reviewed articles and compiled a list of full-text review articles.
5. Both reviewers independently conducted a full-text article review and applied the inclusion/exclusion criteria to the list compiled in step 4, and compiled a list of relevant articles.

The two reviewers discussed and resolved any disagreements to include/exclude articles in the fourth and fifth steps. The levels of agreement between the two reviewers in fourth and fifth steps were assessed using the Cohen Kappa Statistic.

Two methodologies were then used to identify the key factors commonly studied in LPC treatment decision-making:

1. Principal Component Analysis (PCA): Both reviewers discussed and agreed upon the general topics identified within the relevant articles from step 5. A PCA with Promax oblique rotation (loadings greater than 0.275 and less than -0.275 were grouped together) and a parallel analysis (with 1000 Monte Carlo simulation repetitions) were used to identify the underlying LPC treatment decision-making factors from these general topics.¹⁸⁻²⁰
2. Word Cloud: A word cloud was created as a qualitative approach to identify complementary results to the PCA (first method) using word frequencies in the titles and abstracts of the relevant articles.

All authors discussed and agreed upon the interpretations of the key factors identified.

The Cohen Kappa statistic was calculated using IBM SPSS Statistics 22.0. PCA was conducted in Stata IC 12.1. Word Cloud was created in NVivo for Mac 11.4.1.

Results

In step one, the list of references from the five databases contained 1861 items. Next, after duplicates were removed, 1200 articles remained. In step three, 559 articles were excluded (details in Figure 1) and a list of 641 peer-reviewed articles remained. In step four, out of the remaining 641 articles, both reviewers agreed 89 articles needed full-text article review (Cohen's Kappa Statistic 0.789; $p<0.001$). Upon full-text review of these articles, 77 articles were retained (Cohen's Kappa Statistic 0.689; $p<0.001$). Among the retained articles, 55 (71%) were from the US and 22 (29%) from Canada. After the review, 32 general topics studied regarding LPC treatment decision-making were identified and are listed in Table 3.

Applying PCA to the 32 identified topics resulted in five overarching factors (see Table 3): treatment type, socioeconomic/demographic characteristics, personal reasons for treatment choice, psychology of treatment decision experience, and level of involvement in the decision-making process, based on the five highest eigenvalues that were generated from the PCA.

Associated with the highest eigenvalue (see Table 3 for values), the PCA grouped the LPC treatment type (including surgery and radiation therapy) as an overarching factor. Interestingly, LPC treatment type also emerged as the most frequently mentioned topic in the word cloud. Therefore, both methodologies complement each other and show “treatment type” as a frequently studied LPC treatment decision-making factor in the literature.

Associated with the second highest eigenvalue, the PCA grouped age, income, race, insurance coverage and location where they live as another overarching factor. These socioeconomic/demographic characteristics pertain to patient-level information. From the word cloud, topics including “age”, “African American”, “Caucasian”, “education”, and “demographic” emerged, which are complimentary to the identified socioeconomic/demographic characteristics.

Similarly, regarding the third highest eigenvalue, the PCA grouped six different reasons for treatment choice as a third overarching factor (see Table 3 for the list of topics under this factor). These reasons pertain to patient-level reasons for choosing or avoiding a treatment option. Based on the word cloud, topics including “side effects”, “time”, “aid”, “months”, and “personal” emerged, which are complimentary to this identified key factor.

With respect to the fourth highest eigenvalue, the PCA grouped factors pertaining to patients’ psychological experiences during the LPC treatment decision-making process (before and after the decision) as a fourth overarching factor. The topics within this factor include uncertainty faced by patients before the treatment or regret/satisfaction of the decision after the treatment (see Table 3 for other topics within this factor). The list of words including “regret”, “satisfaction”, “conflict”, “quality-of-life”, “uncertainty”, “determined”, and “impact” in the word cloud are related to the psychology of treatment decision experience.

Lastly, the PCA grouped the topics associated with the level of involvement for patients, their families, friends and the healthcare providers as a fifth overarching factor. There were several topics within the word cloud strongly suggestive of the topics associated with the roles in LPC treatment decision-making process, including “influence”, “physician”, “urologist”, “partners”, “considered”, “consultation”, “role”, “knowledge”, “control”, “support” and “involvement”.

Discussion

The PCA computed eigenvalues for each factor. These eigenvalues are a measure of the amount of variation in the information collected from the relevant articles regarding decision-making themes: the higher the eigenvalue, the more frequently articles expressed topics associated with the factor. The eigenvalues do not provide information on the level of importance of the factors. For example, the factor “treatment type” (as discussed later) had the highest eigenvalue in the PCA, which does not imply it is the most important LPC treatment decision-making factor. In general, a factor having a higher eigenvalue does not imply it is more important than factors with lower eigenvalues.

Based on these eigenvalues, our analysis identified five factors commonly studied regarding LPC treatment decision-making, including treatment type, patient socioeconomic/demographic characteristics, personal reasons of patients, psychological factor, and involvement level within the decision-making process. While the scoping review results cannot be used to determine the importance of each of these factors, we hypothesize that they influence LPC treatment decision-making.

Regarding how treatment type may be involved in LPC treatment decision-making, some research suggest patients prefer surgery or radiation therapy due to the perception level regarding side effects and perceived treatment invasiveness.^{12, 14-16, 21-23} Patients tend to prefer information on side effects or survival, which are different for each treatment type.²⁴⁻²⁶ Other work suggests patients might avoid invasive treatments or choose complementary alternative medicine (CAM)

or AS/WW because: (1) they prefer to avoid the side effects of curative treatments; (2) they are waiting for improvements in curative treatment options; and (3) they perceive curative treatments to be inconvenient or a burden.^{9, 11, 13, 27-29}

In terms of how socioeconomic/demographic characteristics, some research studied the roles that age, race, income, education, type of insurance coverage and where one lives might have in LPC treatment decision-making.^{10, 14, 30-35} For example, African-Americans with high risk LPC in the United States are less likely to receive treatment than Caucasians.^{36, 37} Other research suggests the availability of insurance can reduce these racial disparities.^{36, 37} Some patients not undergoing any treatment within six months of diagnosis were more likely to be older age (over 75), non-Caucasians and living in areas with fewer urologists.³¹ Personal reasons for a LPC treatment decision include survival probability, urinary function, rectal function, and ability to work.²⁴⁻²⁶ Some of the articles in this review contained decision aids tools available for educating patients about these personal reasons and assisting patients in making informed decisions.³⁸⁻⁴⁵

Psychological experiences are a fourth factor that the PCA identified. These experiences include such things as feelings of stress, regret, uncertainty and questions regarding quality of life.^{33, 46-49} There were reports of decisional regret among men with treatment side effects such as sexual, bowel or urinary dysfunction.^{33, 46-49} Patients, who felt they were poorly informed or were not prepared enough regarding their treatments, reported to have increased risk of regrets and psychological distress.^{13, 33, 39, 40, 46, 47, 49-56} Men who were more actively involved in the decision-making and had greater knowledge of LPC were less likely to report decisional stress and had higher satisfaction.⁵⁷

The last factor identified by the PCA was level of patient involvement. Some LPC patients prefer an active or collaborative role with their physician in their treatment decision-making.^{13, 15, 30, 38, 58-63} When health care providers included patients in the treatment decision-making process, patients reported higher levels of satisfaction.⁶⁴ Further, when patients discussed their treatment with physicians, families and friends, they reported an improved state of mind and ability to cope with their cancer diagnosis.⁶⁵

Assessing the importance of each of the factors is needed because of their implications for improving patient decision-making experience and healthcare provider knowledge. Further studies are needed to identify the role, if any, that each of these factors have in LPC treatment decision-making. Further studies are also needed to see how the five factors interact with each other in shaping the LPC decision-making experience for patients. For those factors found to influence LPC treatment decision-making, interventions and policies could be developed to improve the decision-making experience for patients.

Conclusion

Our review identifies that there are five factors common to the LPC treatment decision-making literature: treatment type, socioeconomic/demographic characteristics of the patients, personal

reasons of patients, psychological factors, and level of involvement in the decision-making process. Our study provides a basis for future research identifying the importance of each factor, and how they interact with each other in shaping the LPC treatment decision-making experience for patients. This future research has the potential to inform interventions and improve the LPC treatment decision-making experience for patient care.



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Figures and Tables

Fig. 1. Methodology of identifying relevant studies for the scoping review and the results at each step.

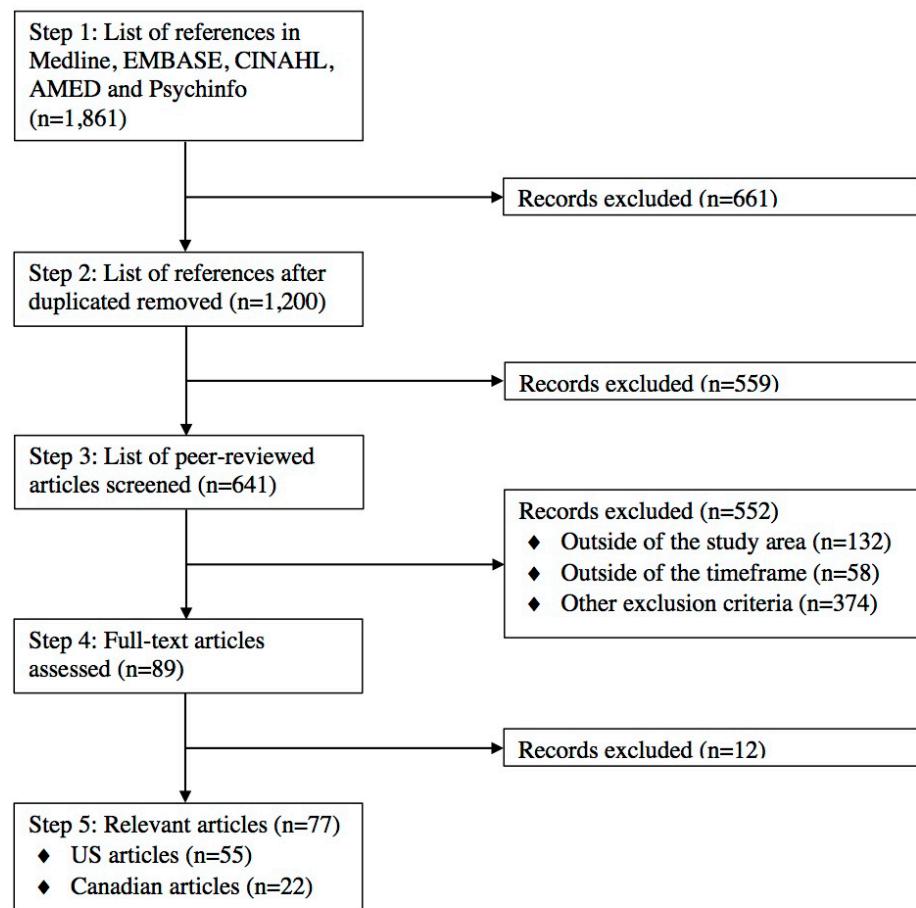


Fig. 2. Word cloud showing the most frequent words appearing in the titles and abstracts of the articles.

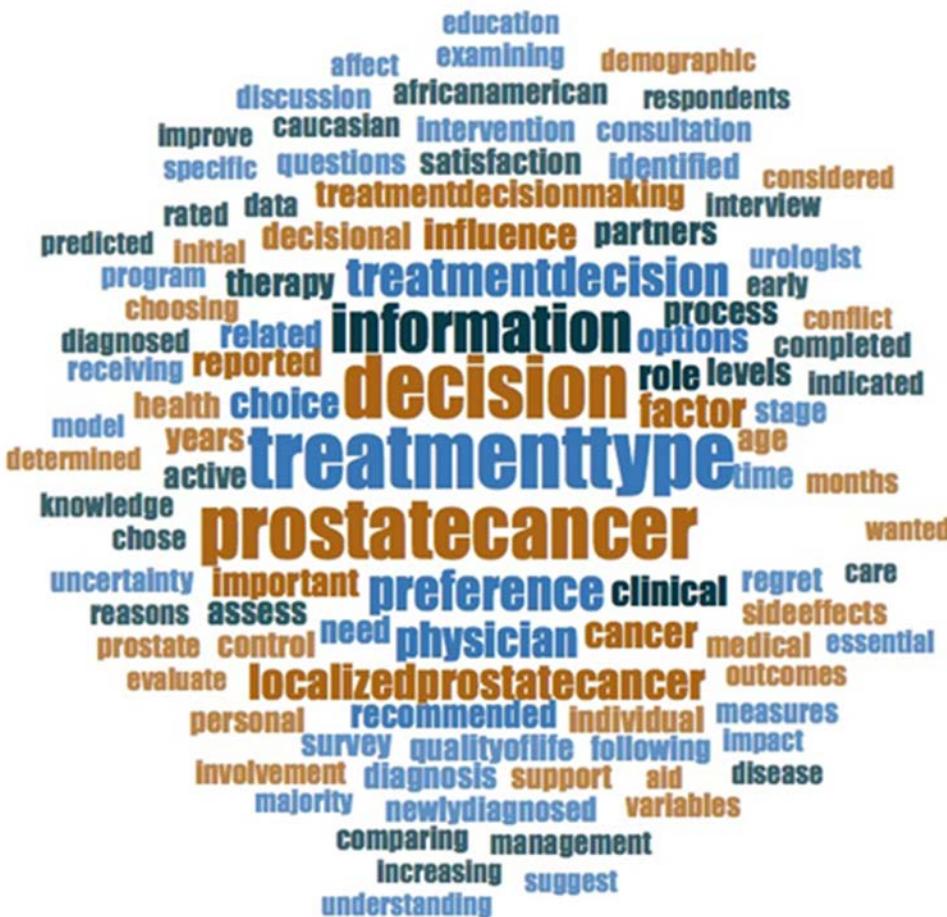


Table 1. Search terms used in the databases

Terms describing prostate cancer	Terms describing treatment decision-making
Prostatic neoplasms	Decision-making
Prostate cancer	Patient preference
Prostatic AND neoplasms	Patient participation
(prostat* adj6 (cancer* or carcinom* or tumor* or tumour* or neoplasm* or adenocarcinom* or intraepithelial))	Decision support techniques Preferences Client participation Decision support systems Consumer participation Decision-making support Choice behaviour

Table 2. Inclusion/exclusion criteria

Inclusion criteria	Exclusion criteria
Peer-reviewed articles	Commentaries, news, abstracts
English language	Editorials, case studies, reviews
Specific to LPC	Duplicate articles
Exclusively regarding LPC	
Specific to treatment decision-making	
Timeframe: September 1997 to August 2016	
Country of the corresponding author: the U.S. or Canada ⁶⁶	

Table 3. Key factors and their associated general topics extracted from the reviewed relevant articles

Key factors (eigenvalue)	General topics	Loadings
Treatment types (4.36) ^{9-16,21-23,26-28,30-35,40,42,46,48-51,54,57,58,60,65,67-86}	Surgery (prostatectomy)	0.4643
	Radiation therapy	0.4093
	Active surveillance/watchful waiting	0.3717
	Brachytherapy	0.3636
	Hormonal therapy	0.2812
Socioeconomic/demographic factors (3.15) ^{10,12,14,15,21,30-35,40,47,49-53,58,68-71,73,75,76,79,82,84-88}	Sociodemographic factors	0.4482
	Monetary influences - cost, insurance	0.3944
	Race	0.3688
	Epidemiological studies on decision-making	0.3436
	Age	0.2766
Personal reasons for treatment choice (2.51) ^{9-16,21-24,27-30,32,33,38-45,47-51,55,59,60,62,67-73,75-78,80,82-91}	Personal decision-making factors	0.4479
	Inconvenience and timing	0.3665
	Utilities and side effects	0.3267
	Fear of death/need for cure	0.3227
	Patient use of decision aids	-0.2893
	Actual or perceived health state/risk	0.2852
Psychology of treatment decision experience (2.34) ^{9,12,13,15,16,23,27,29,30,33,34,39-44,46-55,57,58,60,62,65,67,73,75,76,80-82,84,85,88,89,92}	Confidence, regret and satisfaction	0.4664
	Stress/difficulty in decision-making	0.4338
	Psychology and coping factors	0.3488
	Marital status	0.3344
	Post-treatment quality of life	0.3203

Levels of involvement in decision-making (2.04) ¹¹⁻ 13,15,16,21-30,33,35,38-41,43- 49,51,52,54,55,57-65,67-77,79-93	Physician role and influence	0.4894
	Shared/informed decision-making: active/passive	0.3808
	Behaviour models using economic theories	-0.3649
	Information and knowledge	0.3438
	Partner/family/friend participation and views	0.3038

Note: Principal component analysis accounted for six other topics (“spirituality,” “multidisciplinary practice,” “consulting multiple providers,” “discordant decisions,” “complementary and alternative medicine,” and “health literacy”) partially within all five key factors.

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