Association of marginalization and PSMA-PET in prostate cancer

An analysis of the Ontario PSMA-PET Registry for Recurrent Prostate Cancer

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ABSTRACT

INTRODUCTION: Prostate-specific membrane antigen-positron emission tomography (PSMA-PET) is a new standard for the imaging of high-risk or recurrent prostate cancer. While marginalization disparities exist for prostate cancer, less is known in the context of PSMA-PET. The objective of the study was to determine if marginalization was associated with access, PET positivity, management change, radiation use, and survival of prostate cancer in a universal healthcare system.

METHODS: Patients enrolled in the Ontario PSMA-PET Registry for Recurrent Prostate Cancer (PREP) between 2018 and 2022 were included. The Ontario Marginalization Index (material resources, racialized/newcomer, age/labor force, household/dwellings) was used. Outcomes included access, PET positivity, management change, radiation use, and survival. Cox proportional hazards and logistic regression models examined the association between marginalization and outcomes. Provincial administrative databases were leveraged to generate a diagnosis and a survivorship cohort of prostate cancer patients who received primary treatment to compare with the PSMA-PET cohort.

RESULTS: There were 4034 patients in the PSMA-PET cohort. Patients at higher material marginalization quintiles were under-represented in the PSMA-PET Registry Database. Similar under-representation was noted in the diagnosis (n=123 128) and survival (n=56 753) cohorts. Within the PSMA cohort, marginalization dimensions were not significantly correlated with PET positivity, management change, or radiation use.

CONCLUSIONS: Marginalization quintiles across PSMA-PET access were similar in distribution to prostate cancer diagnoses and survivor cohorts. We found no association of marginalization with PET positivity, management change, or radiation use among those receiving PSMA-PET.

INTRODUCTION

Prostate-specific membrane antigen-positron emission tomography (PSMA-PET) is a new standard for the imaging of men with prostate cancer. There are recommendations by the American Urological Association, Society of Urologic Oncology, and American Society for Radiation Oncology for using PSMA-PET in the staging of high-risk prostate cancers, as well as in the biochemical recurrent and metastatic settings.[1,2]

PSMA-PET tracers have been demonstrated to have higher sensitivity and specificity for detecting small-volume metastatic disease as compared to conventional imaging.[3] This increased accuracy has led to changes in clinical management, as demonstrated by the FALCON trial that found the PSMA-PET scan resulted in a change of management in 64% of biochemical recurrent patients.[4]

Management change in the Ontario prospective multicenter PSMA-PET Registry for Recurrent Prostate Cancer (PREP) cohort has also been previously described, demonstrating a change in 58% of the enrolled patients.[5]

In Ontario, Canada, initial access to PSMA-PET was available through the PREP registry. This registry was launched in 2018 and offered the scans at six academic hospitals across the province of Ontario using the PSMA tracer (^{18}F)–DCFPyL[6] under a Health Canada clinical trials application, as there were no Health Canada-approved PSMA-PET radiopharmaceuticals at the time the registry was launched.

KEY MESSAGES

- In Ontario, Canada, access to PSMA-PET is available through a prospective, multicenter registry and is covered by the Provincial Health Agency.
- Prior studies have shown differences between prostate cancer socioeconomic groups in the Ontario prostate cancer context.
- We found lower socioeconomic groups were under-represented among men receiving PSMA-PET, like Ontario Diagnostic and Survivor cohorts.
- We found no association of marginalization disparities with PET positivity, management change, or radiation use among those receiving PSMA-PET.

Canada has universal access to healthcare, including cancer care services, through a public single-payer system; however, even in the context of publicly funded healthcare, socioeconomic status (SES) disparities can exist in prostate cancer. A previous study in Manitoba, Canada, reported that as income levels increased, patients were more likely to receive radical prostatectomy rather than radiation for localized prostate cancer.[7] In addition, lower-income prostate cancer patients had reduced survival compared to higher-income patients in the Danish public healthcare system;[8] however, less is known regarding SES in the context of PSMA-PET.

One objective of this study was to determine if marginalization was associated with PSMA-PET access, PET positivity, management change, radiation use, and survival of prostate cancer patients in a universal healthcare system. For example, increased marginalization might be anticipated to result in delays in access to appropriate diagnostics, like PSMA-PET, or reduced access to therapies required after diagnostics, like radiotherapy.

METHODS

Study cohorts and data sources

The Ontario PREP, as well as provincial administrative databases, were used to conduct this study. Patients who received a PSMA-PET scan were identified from the prospective PREP registry (NCT03718260). Details regarding the registry have been previously described.[5]

In summary, patients were included between December 2018 and September 2022 if they met criteria in one of six predefined cohorts:

- Cohort 1 included patients who were node-positive or had persistently detectable prostate-specific antigen (PSA) within three months after radical prostatectomy.
- Cohort 2 included patients with biochemical failure after initial radical prostatectomy.
- Cohort 3 included patients with biochemical failure after radical prostatectomy followed by adjuvant salvage pelvic radiotherapy.
- Cohort 4 included biochemical failure after radical prostatectomy despite salvage hormone therapy.
- Cohort 5 included biochemical failure after radical prostatectomy following lesion-directed treatment or oligometastatic disease.
- Cohort 6 included biochemical failure following primary radiation therapy.

A small number of patients were imaged under "cohort 7" as an adjudicated access process for indications outside of the other clinical scenarios. Patients reported here were limited to cohorts 1–6. Patients initially required conventional imaging, including computed tomography (CT) abdomen/pelvis, bone scan within three months of study enrollment, and PET imaging to rule out extensive metastases based on conventional imaging. In 2020, eligibility criteria were changed to require conventional imaging for cohorts 1–6 only if the PSA at enrollment was >10 ng/ml given the low diagnostic yield of conventional imaging for extensive metastases at lower PSA levels.

Patients were excluded if the prostate cancer has substantial sarcomatoid, spindle cell, or neuroendocrine small cell components, extensive metastatic disease with conventional scans (>4 metastatic sites), prior PSMA-PET within six months and Eastern Cooperative Oncology Group (ECOG) performance status >1.

Ontario marginalization index

The Ontario Marginalization Index (ONMARG) — incorporating metrics of material resources, racialized and newcomer, age and labor force, and household and dwellings — was used to assess measures of marginalization.[9] The measures are based on data from the dissemination areas of the Canadian census. The first quintile represents the least marginalized, while the fifth quintile represents the most marginalized.

Material resources indicators include the proportion of the population unemployed, low-income, no high-school diploma, lone-parent families, total income from government transfer payments, and living in dwellings in need of repair. Racialized and newcomer indicators include the proportion of the population who are recent immigrants or who self-identify as a visible minority. Age and labor force indicators include the proportion of the population aged 65 and not participating in the labor force. Housing and dwellings indicators include the proportion of the population living alone, in apartment buildings, in dwellings not owned, single/divorced/widowed, moved in the past five, years and number of persons per dwelling.

Marginalization was compared with a diagnosis cohort and a survivorship cohort. The diagnosis cohort consisted of patients with incident prostate cancer diagnosis between November 2018 and March 2023 identified from the Ontario Cancer Registry (OCR). Patients were excluded if they had missing marginalization information. The survivorship cohort consisted of patients among the diagnosis cohort who were alive on March 31, 2023, and who received primary cancer treatment at least one year prior. Patients were excluded if they had stage IV cancer or no evidence of a cancer treatment.

Radiation use

A key management change resulting from PSMA-PET is the use of lesion-directed therapy like stereotactic radiation. Access to radiation treatments can potentially also be affected by marginalization. We examined radiation use as a function of marginalization among the PSMA-PET cohort. Radiation treatment information was retrieved from the Cancer Activity Level Reporting (ALR).

Patient characteristics

Age was defined as age at time of scan. Residence (urban vs. rural) and neighborhood income quintile (after tax) was retrieved from the Canadian census by postal code. PSA at baseline was defined at time of PSMA-PET scan. Time between primary treatment and PSMA-PET scan was categorized as <2 vs. ≥2 years. Conventional imaging included CT, magnetic resonance imaging (MRI), or bone scan. Metastasis type included bone only, lymph node only, mixed, viscera only, and none. The extent of metastasis derived from PSMA-PET included no local only, locoregional failure, extensive metastasis, oligometastatic, and no metastasis.

Outcomes

Outcomes included access, survival, PET positivity, management change, and radiation use. PET positivity was based on a positive PSMA-PET result. Management change was based on the pre-PET and post-PET questionnaires completed by the referring physician as part of the registry documenting intended treatment. Radiation use was identified in the ALR and was defined as use within six months of the PSMA-PET scan.

Statistical analysis

Descriptive analyses were performed using the Chi-squared test to compare proportions within categorical variables and analysis of variance (ANOVA) test to compare means of continuous variables between pre- and post-regionalization intervals. We used logistic regression models to assess the association between each of the four ONMARG dimensions and PET positivity, change in management, and radiation use, with adjustment for covariates. We reported odds ratios (ORs) of outcome in ONMARG dimension quintiles 2–5 vs. quintile 1 (least marginalized) with 95% confidence intervals (CIs). We also used Cox proportional hazards models and reported hazards ratios (with 95% CIs) of all-cause mortality following PSMA-PET scan in ONMARG dimension quintiles 2–5 vs. quintile 1.

For model covariates, we adjusted for age, patient residence, neighborhood income quintile, time between primary treatment and scan, patient recruitment phase, biochemical failure type, PSA at the time of scan, extent of metastasis derived from PSMA-PET (not included in the logistic regression models, where our binary outcome was PET positivity), and treatment management change (only included in logistic regression models where our binary outcome was radiation use).

Neighborhood after-tax income quintile was not included as a covariate in the logistic or Cox proportional hazards models, which included ONMARG material resources marginalization to avoid multicollinearity between these variables. Similarly, residence type was not included in the models, which included ONMARG household and dwelling marginalization, and age was excluded as a covariate from the model that included age and labor force marginalization. All covariates were chosen a priori.

Additionally, we used univariate logistic regression models to calculate ORs associated with being from the diagnosis cohort vs. the PSMA-PET cohort and the survivorship cohort vs. the PSMA-PET cohort within each of the ONMARG dimension quintiles.

Analyses were conducted using SAS software, version 9.4 (Cary, NC, U.S).

RESULTS

Baseline characteristics

The baseline characteristics of the 4034 patients identified in the PSMA-PET cohort are described in Table 1. The median age was 71 years. Eighty-eight percent of the cohort lived in urban residences compared to 12% who lived in rural residences. Patients from the highest material resources marginalization quintile (5) were more likely to be from urban residences compared to the lowest quintile (92.7% vs. 90.3%, p<0.0001). When stratified by material resources marginalization, there was no difference in baseline disease characteristics across the marginalization quintiles, including baseline PSA (p=0.71), Gleason grade (p=0.83), and metastases type (p=0.39).

The time between primary treatment and PSMA-PET scan for the majority of patients (76.9%) was >2 years. The overall PSMA-PET positivity rate was 70.5%. Findings of the PSMA-PET included local disease (16.4%), locoregional failure (16.8%), oligometastatic (24.8%), extensive metastases (12.5%), and negative (29.5%).

Table 1. Baseline characteristics for patients stratified by Ontario Materialization Index material resources marginalization dimension

Characteristic	Total (n=4034)	Quintile 1 (n=1124)	Quintile 2 (n=910)	Quintile 3 (n=778)	Quintile 4 (n=700)	Quintile 5 (n=523)	p
Age	71.0 (66.0–76.0)	72.0 (67.0–76.0)	71.0 (66.0–76.0)	71.0 (67.0–75.0)	72.0 (67.0–76.0)	71.0 (65.0–76.0)	0.0691
Residence							<0.0001
Urban	3546 (88.0%)	1011 (90.3%)	777 (85.6%)	663 (85.2%)	610 (87.1%)	485 (92.7%)	
Rural	483 (12.0%)	109 (9.7%)	131 (14.4%)	115 (14.8%)	90 (12.9%)	38 (7.3%)	
Neighborhood income quintile							
1	558 (13.8)						
2	715 (17.7)						
3	800 (19.8)						
4	843 (20.9)						
5	1118 (27.7)						
PSA at baseline							0.7107
<0.3 ng/mL	868 (21.5)	451 (11.2)	133 (11.8)	104 (11.4)	88 (11.3)	69 (9.9)	
0.3–<0.5 ng/mL	451 (11.2)	507 (12.6)	136 (12.1)	116 (12.7)	87 (11.2)	102 (14.6)	
0.5–<1.0 ng/mL	507 (12.6)	2209 (54.7)	603 (53.6)	497 (54.6)	424 (54.5)	394 (56.3)	
1.0+ ng/mL	2209 (54.7)	868 (21.5)	252 (22.4)	193 (21.2)	179 (23.0)	135 (19.3)	
Time between primary treatment and scan							0.0366
2+ years	3081 (76.9)	881 (79.3)	705 (77.9)	595 (76.8)	505 (73.1)	395 (75.7)	
<2 years	923 (23.1)	230 (20.7)	200 (22.1)	180 (23.2)	186 (26.9)	127 (24.3)	
Gleason grade group							0.8319
1–3	1530 (74.2)	1530 (74.2)	420 (73.0)	338 (74.4)	301 (73.8)	274 (74.1)	
4–5	533 (25.8)	533 (25.8)	155 (27.0)	116 (25.6)	107 (26.2)	96 (25.9)	
Conventional imaging							0.5336
Positive	285 (24.7)	285 (24.7)	89 (25.9)	67 (27.0)	53 (25.2)	42 (21.0)	
Negative	871 (75.3)	871 (75.3)	254 (74.1)	181 (73.0)	157 (74.8)	158 (79.0)	

Data are presented as n (%) or median (interquartile range). Bold p-values represent statistical significance. PSA: prostate-specific antigen; PSMA-PET: prostate-specific membrane antigen-positron emission tomography.

Table 1 cont'd. Baseline characteristics for patients stratified by Ontario Materialization Index material resources marginalization dimension							
Characteristic	Total (n=4034)	Quintile 1 (n=1124)	Quintile 2 (n=910)	Quintile 3 (n=778)	Quintile 4 (n=700)	Quintile 5 (n=523)	p
PSMA-PET result							0.5989
Positive	2845 (70.5)	2845 (70.5)	775 (69.0)	639 (70.2)	550 (70.7)	503 (71.9)	
Negative	1190 (29.5)	1190 (29.5)	349 (31.0)	271 (29.8)	228 (29.3)	197 (28.1)	
Metastasis type							0.3850
Bone only	365 (9.0)	365 (9.0)	98 (8.7)	85 (9.3)	63 (8.1)	73 (10.4)	
Lymph node only	1331 (33.0)	1331 (33.0)	359 (31.9)	312 (34.3)	253 (32.5)	236 (33.7)	
Mixed	418 (10.4)	418 (10.4)	111 (9.9)	104 (11.4)	86 (11.1)	67 (9.6)	
Viscera only	69 (1.7)	69 (1.7)	15 (1.3)	13 (1.4)	19 (2.4)	17 (2.4)	
None	1852 (45.9)	1852 (45.9)	541 (48.1)	396 (43.5)	357 (45.9)	307 (43.9)	
Derived finding							0.2550
Local only	662 (16.4)	662 (16.4)	192 (17.1)	125 (13.7)	129 (16.6)	110 (15.7)	
Locoregional failure	678 (16.8)	678 (16.8)	190 (16.9)	165 (18.1)	121 (15.6)	123 (17.6)	
Extensive metastasis	505 (12.5)	505 (12.5)	123 (10.9)	121 (13.3)	96 (12.3)	93 (13.3)	
Oligometastatic	1000 (24.8)	1000 (24.8)	270 (24.0)	228 (25.1)	204 (26.2)	177 (25.3)	
No metastasis	1190 (29.5)	1190 (29.5)	349 (31.0)	271 (29.8)	228 (29.3)	197 (28.1)	
Patient cohort							0.2118
1	248 (6.1)	65 (5.8)	56 (6.2)	43 (5.5)	49 (7.0)	35 (6.7)	
2	1461 (36.2)	432 (38.4)	314 (34.5)	280 (36.0)	246 (35.1)	189 (36.1)	
3	1020 (25.3)	281 (25.0)	255 (28.0)	173 (22.2)	184 (26.3)	127 (24.3)	
4	257 (6.4)	65 (5.8)	52 (5.7)	55 (7.1)	50 (7.1)	35 (6.7)	
5	171 (4.2)	57 (5.1)	30 (3.3)	41 (5.3)	21 (3.0)	22 (4.2)	
6	878 (21.8)	224 (19.9)	203 (22.3)	186 (23.9)	150 (21.4)	115 (22.0)	
Treatment management change	2016 (50.0)	547 (48.7)	475 (52.2)	372 (47.8)	355 (50.7)	267 (51.1)	0.3525
Use of radiotherapy within 6 months following scan	1716 (42.5)	481 (42.8)	392 (43.1)	330 (42.4)	292 (41.7)	221 (42.3)	0.9861
Death	139 (3.4)	31 (2.8)	24 (2.6)	34 (4.4)	31 (4.4)	19 (3.6)	0.1129

Data are presented as n (%) or median (interquartile range). Bold p-values represent statistical significance. PSA: prostate-specific antigen; PSMA-PET: prostate-specific membrane antigen-positron emission tomography.

Access

Patients at higher material marginalization quintiles were under-represented in the PSMA-PET cohort (Q1 27.81%, Q2 22.58%, Q3 19.33%, Q4 17.29%, Q5 13.00%).

We compared access among patients in the PSMA-PET cohort with two other provincial cohorts. Under-representation at higher material marginalization quintiles of the PSMA-PET cohort were also demonstrated in the diagnosis cohort (n=123 128) and a survival cohort (n=56 753). Similar to the PSMA-PET cohort, under-representation was also noted in the diagnosis (Q1 23.7%, Q2 22.5%, Q3 20.0%, Q4 17.7%, Q5 16.0%) and survival (Q1 23.7%, Q2 21.9%, Q3 20.1%, Q4 18.2%, Q5 16.0%) cohorts (Table 2).

Patients in the least marginalized quintile were significantly more likely to be in the PSMA cohort compared to the diagnosis (Q1 OR 1.24, 95% CI 1.16–1.34, p<0.0001) or survival (Q1 OR 1.24, 95% CI 1.15–1.33], p<0.0001) cohort. Meanwhile, patients in the

Table 2. Ontario marginalization index quintiles stratified by PSMA-PET cohort, diagnosis cohort, and survival cohort			
	Cohorts		
Quintiles	PSMA-PET (n=4034)	Diagnosis (n=27 502)	Survival (n=56 732)
Material resources			
Q1 (least marginalized)	1124 (27.86%)	6517 (23.70%)	13462 (23.73%)
Q2	910 (22.55%)	6188 (22.50%)	12439 (21.93%)
Q3	778 (19.28%)	5511 (20.04%)	11411 (20.11%)
Q4	700 (17.35%)	4866 (17.69%)	10318 (18.19%)
Q5 (most marginalized)	523 (12.96%)	4420 (16.07%)	9102 (16.04%)
Racialized and newcomer			
Q1 (least marginalized)	834 (20.67%)	5748 (20.90%)	11795 (20.79%)
Q2	837 (20.74%)	5805 (21.11%)	11810 (20.82%)
Q3	859 (21.29%)	5548 (20.17%)	11606 (20.46%)
Q4	784 (19.43%)	5305 (19.29%)	11203 (19.75%)
Q5 (most marginalized)	721 (17.87%)	5096 (18.53%)	10318 (18.19%)
Age and labor force			
Q1 (least marginalized)	633 (15.69%)	4506 (16.38%)	8634 (15.22%)
Q2	731 (18.12%)	4833 (17.57%)	9532 (16.80%)
Q3	725 (17.97%)	4881 (17.75%)	10138 (17.87%)
Q4	817 (20.25%)	5524 (20.09%)	11280 (19.88%)
Q5 (most marginalized)	1129 (27.98%)	7758 (28.21%)	17148 (30.23%)
House and dwellings			
Q1 (least marginalized)	819 (20.30%)	5240 (19.05%)	10562 (18.62%)
Q2	801 (19.85%)	5425 (19.73%)	10967 (19.33%)
Q3	877 (21.73%)	5680 (20.65%)	11446 (20.18%)
Q4	732 (18.14%)	5373 (19.54%)	11356 (20.02%)
Q5 (most marginalized)	806 (19.98%)	5784 (21.03%)	12401 (21.86%)

Data are presented as n (%). PSMA-PET: prostate-specific membrane antigen-positron emission tomography.

most marginalized quintile were less likely to be in the PSMA cohort as compared to the diagnosis (Q5 OR 0.78, 95% CI 0.71–0.86, p<0.0001) or survival (Q5 OR 0.78, 95% CI 0.71–0.86, p<0.0001) cohorts.

PET positivity, management change, radiation use

Within the PSMA-PET cohort, there was no significant difference in PET positivity (p=0.60), management change (p=0.99), or radiation use (p=0.11) across the material resources marginalization quintiles (Figure 1). Table 3 reports the ORs for PET positivity, management change, and radiation use by all OMMARG index dimensions. Marginalization quintiles were not significantly correlated with PET positivity (material p=0.94, racialized/newcomer p=0.04, age/labor p=0.72, household/dwellings p=0.56), change in management (material p=0.40, racialized/newcomer p=0.86, age/labor p=0.06, household/dwellings p= 0.99), or radiation use (material p=0.96, racialized/newcomer p=0.25, age/labor p=0.05, household/dwellings p=0.30).

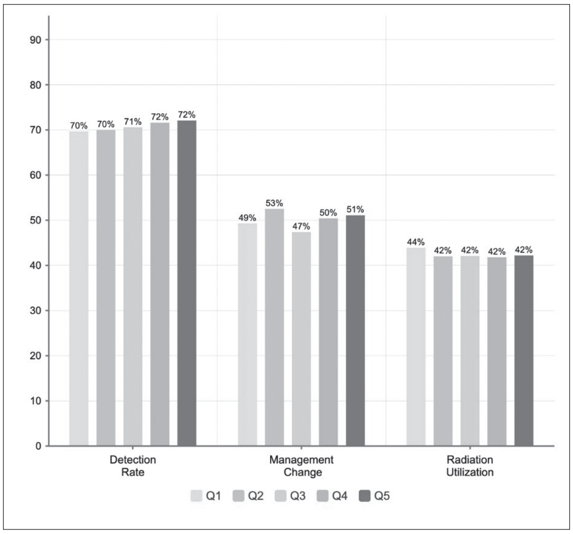

Figure 1. Distribution of positron emission tomography (PET) positivity, management change, and radiation use of the prostate-specific membrane antigen (PSMA)-PET cohort across material resources marginalization quintiles.

Survival

After adjusting for patient factors, increased material marginalization was positively correlated with increased all-cause mortality (adjusted hazards ratio (95% CI) vs. Q1: Q2: 1.02 [0.59–1.75], Q3: 1.67 [1.01–2.76], Q4: 1.81 [1.07–3.07], Q5: 1.44 [0.76–2.67])(Table 4). The Cox proportional hazards model for material marginalization is reported in Figure 2.

DISCUSSION

Lower resource populations were less commonly represented in the PSMA-PET cohort and distributions were comparable to the general prostate cancer diagnosis and survivorship cohorts. As material marginalization increased, there was a gradient of increasing all-cause mortality; however, PSMA-PET-related parameters and outcomes were not affected. This includes no statistically significant association of marginalization with PET positivity, management change, or radiation use among those receiving PSMA-PET. The finding that the lowest marginalization quintile was also less likely to be represented in the diagnostic and treatment cohorts suggests that inequities to appropriate prostate care may lie primarily at the "front end" of access, with less inequities experienced among men who are already "in the system" and receiving care.[10,11]

In a previous study, Washington and Deville Jr. reviewed inequities in diagnostic imaging for prostate cancer and found race, age, and SES to be important variables. Patients with higher income were more likely to receive appropriate imaging according to guidelines.[12] In an analysis of the Surveillance, Epidemiology, and End Results (SEER)-Medicare database in the U.S., patients in the highest income quintiles were more likely to have overuse of bone scans and pelvic CT/MRIs.[13]

In Australia, with the introduction of a government rebate, access to MRI for prostate cancer staging improved in disadvantaged populations, as measured by the Index of Relative Socioeconomic Advantage and Disadvantage (IRSAD); however, access to PET imaging remained poor in patients with lower SES at the time of the analyses, with the absence of federal funding.[14] This highlights the need to consider socioeconomic factors to ensure optimal use of diagnostic imaging in men with prostate cancer.

Strengths and limitations

To our knowledge, this is the first study assessing the impact of marginalization on PSMA-PET use. Strengths of the study includes province-wide access to PSMA-PET, with linkages to provincial databases for outcomes like survival and radiation use. In addition, marginalization quintiles for the PSMA-PET cohort were compared to large diagnosis and survivor cohorts to allow for comparability to the general prostate cancer population.

Limitations of the study include the use of restricted data based on available databases. For example, access to information on PSA laboratory data, pathologic grade, use of systemic therapies, and interventions other than radiation was not available for our analysis. In addition, the ONMARG is designed to measure marginalization at an area level based on postal code. This means it may not accurately reflect individual experiences of marginalization.

Our study findings must also be carefully considered when being compared to other regions in Canada, and cannot be generalized to non-universal healthcare systems. Additionally, race and ethnicity were not available, although visible minorities are partly accounted for in the racialized and newcomer indicator in the ONMARG. Stern et al have noted that there was a lower risk of prostate cancer-specific mortality among South Asian men in Canada.[15] While Black race has been established as a risk factor for prostate cancer mortality, there was no observation of increased risk of prostate cancer mortality among Black men in that study. As investigated by Patki et al, there is poor reporting of race, ethnicity, SES, and education attainment in randomized trials in prostate cancer.[16] Of 256 trials, only three reported education attainment and one reported SES. We support continued research in disparities, even in a universal healthcare system.

Table 3. Odds ratios for PET positivity, change in management, and radiation use by Ontario marginalization index quintiles of material resources, racialized and newcomer, age and labor force, and house and dwellings

Quintiles	PET positivity†	Change in management‡	Radiation use‡
Material resources			
Q1 (least marginalized)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Q2	1.00 (0.81–1.25)	1.17 (0.96–1.43)	1.03 (0.85–1.25)
Q3	1.06 (0.84–1.33)	0.96 (0.78–1.19)	1.04 (0.85–1.29)
Q4	1.06 (0.83–1.36)	1.03 (0.82–1.29)	0.96 (0.77–1.20)
Q5 (most marginalized)	1.11 (0.84–1.48)	1.09 (0.84–1.41)	1.04 (0.80–1.34)
Racialized and newcomer			
Q1 (least marginalized)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Q2	0.86 (0.68–1.10)	1.05 (0.85–1.31)	0.98 (0.79–1.21)
Q3	0.81 (0.64–1.03)	0.94 (0.75–1.16)	0.97 (0.78–1.21)
Q4	0.67 (0.52–0.86)	1.02 (0.82–1.28)	1.12 (0.89–1.40)
Q5 (most marginalized)	0.79 (0.60–1.04)	1.02 (0.80–1.31)	0.85 (0.66–1.08)
Age and labor force			
Q1 (least marginalized)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Q2	0.91 (0.70–1.19)	**1.35 (1.06-1.72)**	**0.97 (0.76-1.24)**
Q3	0.85 (0.65–1.12)	1.22 (0.95–1.56)	0.95 (0.74–1.22)
Q4	0.83 (0.64–1.09)	**1.36 (1.07-1.73)**	1.27 (1.00–1.61)
Q5 (most marginalized)	0.88 (0.67–1.14)	**1.36 (1.07-1.73)**	1.16 (0.92–1.47)
House and dwellings			
Q1 (least marginalized)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Q2	0.85 (0.67–1.08)	1.01 (0.81–1.26)	0.83 (0.67–1.04)
Q3	0.89 (0.70–1.14)	0.95 (0.76–1.19)	0.81 (0.65–1.01)
Q4	0.98 (0.75–1.27)	0.97 (0.77–1.23)	0.80 (0.64–1.02)
Q5 (most marginalized)	1.02 (0.78–1.34)	0.99 (0.78–1.25)	0.82 (0.65–1.05)

Data are presented as odds ratios (95% confidence interval). Bold odds ratios represent statistical significance. †Adjusted for treatment scan time, study phase, patient cohort, PSA value. ‡Adjusted for treatment scan time, study phase, patient cohort, PSA value, metastasis type, PET result. PET: positron emission tomography; PSA: prostate-specific antigen; Q: quintile.

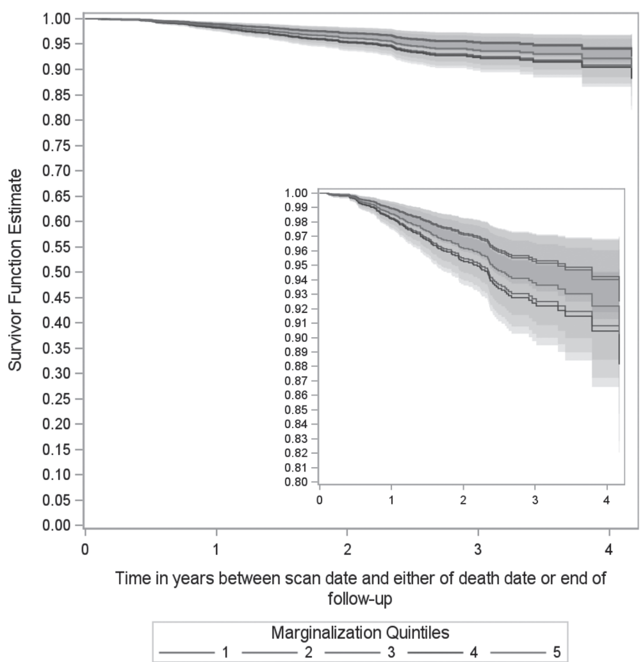

Figure 2. Cox proportional hazards model by Ontario Marginalization Index material resources marginalization dimension.

Table 4. Multivariable Cox proportional hazard model by Ontario marginalization index quintiles of material resources, racialized and newcomer, age and labor force, and house and dwellings†

Quintiles	Survival†
Material resources	
Q1 (least marginalized)	1.00 (Reference)
Q2	1.02 (0.59–1.75)
Q3	1.67 (1.01–2.76)
Q4	1.81 (1.07–3.07)
Q5 (most marginalized)	1.44 (0.76–2.67)
Racialized and newcomer	
Q1 (least marginalized)	1.00 (Reference)
Q2	0.54 (0.29–0.97)
Q3	1.13 (0.69–1.86)
Q4	1.14 (0.69–1.90)
Q5 (most marginalized)	0.84 (0.46–1.50)
Age and labor force	
Q1 (least marginalized)	1.00 (Reference)
Q2	0.99 (0.53–1.82)
Q3	0.68 (0.36–1.29)
Q4	0.96 (0.53–1.75)
Q5 (most marginalized)	1.03 (0.60–1.83)
House and dwellings	
Q1 (least marginalized)	1.00 (Reference)
Q2	1.33 (0.76–2.37)
Q3	1.35 (0.79–2.34)
Q4	1.11 (0.61–2.02)
Q5 (most marginalized)	0.98 (0.54–1.80)

Data are presented as hazard ratios (95% confidence interval). †Adjusted for treatment scan time, study phase, patient cohort, PSA value, metastasis type. PSA: prostate-specific antigen; Q: quintile.

CONCLUSIONS

Disparities in accessing PSMA-PET were similar as compared to the marginalization quintile distributions for prostate cancer diagnoses and survivors. We further found no association of marginalization with PET positivity, management change, or radiation use among those receiving PSMA-PET. Taken together, our data suggests equitable access to appropriate prostate care diagnostics and therapies, in general, is an overarching concern vs. additional factors specific to PET scanning. Identifying disparities will help to improve equitable access to healthcare resources, such as PSMA-PET, in the future.

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