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Research Article

Correlation of Occupational Exposure and Risk of Genitourinary Malignancies: A Canadian Population Study

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ABSTRACT

Objectives: Examining the impact of occupational exposure on malignancy is important in risk stratifying individual patients. To this end, our analyses focus on explaining the industrial effects on bladder, kidney and prostate cancer. Methods: Data were obtained from a population-based linked dataset, Canadian Census Health and Environment Cohort. Approximately 2.7 million people aged 25 or older who responded to the 1991 long-form Census questionnaire were linked with the Canadian Cancer Registry. Inclusion criteria included diagnosis between June 4, 1991, and December 31, 2010. Cox Proportional Hazards models were used to predict incidences of cancer with the agricultural industry as a reference point. Sex-specific analyses were then carried out. Results: Bladder cancer was diagnosed in 6970 men and 1665 women. The real estate industry was associated with increased risk for both sexes (men: hazard ratio [HR] 1.34; 95% confidence interval [CI]: 1.12-1.62, p<0.01; women: HR 1.63; 95% CI: 1.12-2.37, p< 0.05). Kidney cancer incidence was 4380 men and 1900 women. Health and social service was the only industry with increased risk for both men (HR 1.30; 95% CI: 1.04-1.62, p<0.05) and women (HR 1.36; 95% CI: 1.01-1.83, p<0.05). Prostate cancer incidence was 35220 men. A number of industries had a lower risk of prostate cancer diagnoses, such as accommodation and food (HR 0.77; 95% CI: 0.70-0.84, p<0.0001), when compared to the agriculture industry. Conclusions: Multivariate analysis, controlling for socioeconomic factors, found effects of real estate industry and health and social service consistently for both sexes in bladder and kidney cancer diagnosis, respectively. Prostate cancer incidence was highest in men from the agriculture industry.

Keywords: Bladder cancer; Occupational exposure; Prostate cancer; Kidney cancer

INTRODUCTION

Genitourinary (GU) malignancies are among the most prevalent of the neoplasms, with prostate cancer being most commonly diagnosed in Canadian men [1]. An estimated 4000 deaths are attributed to prostate cancer, with 2500 for bladder and 1900 for kidney cancers in 2019. Due to their high incidence, environmental and occupational risk factors are of interest. Several occupational risk factors for GU malignancies have been reported.

A large Nordic study (15 million participants) reported that administrative workers, medical professionals, and military personnel were at higher risk of prostate cancer diagnosis [2]. Within Canada, a smaller case-control study (n=1737 cancer cases), found a number of industries including farming, armed forces, legal work, office work and plumbing were associated with higher risk of prostate cancer [3]. In a larger Ontario based cohort of 1 million male workers, there was increased risk of diagnosis among construction workers, teachers and fire fighters [4]. Reports focusing on firefighting have highlighted elevated risks for prostate and bladder cancer [5,6].

Unlike prostate cancer, the occupational hazards to bladder cancer are better established. Occupations with increased exposure to aromatic hydrocarbons have been associated with higher bladder cancer risks [7,8]. In addition, occupations where smoking may be more prevalent, such as restaurant servers, have been shown to have increased risk [2]. Similar to prostate cancer, kidney neoplasms have not been associated with specific environmental exposures. The larger Nordic study only found an association for male waiters with increased risk of kidney cancer [2]. A smaller Icelandic study (n=18,840) found increased risk in painters, aircraft mechanics

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and shipbuilders [9]. There have been suggestions of exposure to chemical solvents, such as trichloroethylene, leading to mutations in the Von Hippel-Lindau gene [10].

The correlation between occupational exposures to the common GU malignancies is variable dependent on the reported population. This study aims to look at a large Canadian population cohort and their risk of cancer diagnosis after controlling for a variety of socio-economic factors.

MATERIALS AND METHODS

Data used in this paper come from a population-based linked dataset called the 1991 Canadian Census Health and Environment Cohort (CanCHEC). The 1991 CanCHEC is based on approximately 2.7 million people aged 25 or older who responded to the 1991 long-form Census questionnaire. Individuals in this Census cohort were linked to their tax files, cancer registry, and mortality records. The 1991 CanCHEC is comprised of the 1984-2011 Historical Tax Summary Files, the 1969-1991 Canadian Cancer Database, the 1992-2010 Canadian Cancer Registry, and the 1991-2011 Canadian Mortality Database, with baseline characteristics coming from the 1991 Census. In order to be included in our analytical sample, the following criteria had to be met: (1) must not be unemployed, and (2) must not be missing on income. Overall, this dataset allows us to investigate the association between demographic and geographic indicators and specific cancer outcomes.

Our analysis focuses on explaining the industrial effects on three forms of urological cancer: bladder, kidney and prostate. The cancer registries in the CanCHEC report individuals' date of diagnosis and tumour site. We exclude those who were diagnosed prior to 1991 to establish the temporal ordering between their industry and demographic characteristics and subsequent diagnoses. Thus, our analytical sample contain individuals who were diagnosed with a urological cancer between June 4, 1991 and December 31, 2010. The site of the tumour was reported using ICD-9 or 10 codes.

Individuals' industry of work was identified on the 1991 Census. They were coded by the industry division according to the 1980 Standard Industrial Classification and include industries related to: agricultural and related service, fishing and trapping, logging and forestry, mining quarrying and oil well, manufacturing, construction, transportation and storage, communication and other utility, wholesale trade, retail trade, finance and insurance, real estate operator and insurance agent, business services, government services, educational services, health and social services, accommodation, food and beverage services, and other services. Our analytical sample only includes those who are employed in the labour market because we are investigating how ones' field of work is associated with the likelihood of them getting a urological cancer. Industry of work in the CanCHEC is a baseline characteristic and reflects the individuals' industry in 1991.

Like the industry variables, our demographic predictors are also measured in 1991. These include the individuals' age, marital status, education, visible minority status, income (logged) and province of residence.

We ran Cox Proportional Hazards models to predict the incidence of bladder cancer, kidney cancer, and prostate cancer separately. For bladder cancer and kidney cancer, we ran separate sex-specific models to compare how industry of work affects cancer incidence for men versus women. In survival analysis, only those who have a known date of diagnosis were considered as experiencing the event. Individuals who died before being diagnosed were censored, and the date of death was determined using the earliest date reported on the tax, cancer registry or mortality records.

RESULTS

We report on observed count of bladder, kidney and prostate cancer in 2.7 million people aged 25 or older who responded to the 1991 long-form Census questionnaire (Table 1).

Bladder Cancer

For males, 6970 men were diagnosed with bladder cancer. Univariate analysis (Supplementary Table S1), found incidence increased with age, with 75-84 year olds being much more likely to be diagnosed with bladder cancer than 25-34 year olds (HR 109.38; 95% CI: 81.18-135.69, $p<0.0001$). Education had a protective effect with university level education being protective, compared to non-completion of high school (HR 0.74; 95% CI: 0.68-0.81, $p<0.0001$). Multivariate analysis showed bladder cancer incidence among men was significantly greater in a number of industries {with reference to agriculture, (Table 2)}, and the greatest effects were seen in: manufacturing (HR 1.27; 95% CI: 1.12-1.43, $p<0.0001$), wholesale trade (HR 1.29; 95% CI 1.11-1.49, $p < 0.001$) and business (HR 1.29; 95% CI: 1.11-1.50, $p<0.001$).

Among women, 1665 were diagnosed with bladder cancer. Similar to the male cohort, univariate analysis (Supplementary Table S2) found incidence was higher in older age groups compared to 25-34 year olds (age 75-84, HR 50.78; 95% CI: 31.76-81.20, $p < 0.0001$), and higher education levels being protective (university vs. no high school, HR 0.60; 95% CI: 0.49-0.74, $p < 0.0001$). Multivariate analysis found the incidence of bladder cancer was only associated with the real estate industry (HR 1.63; 95% CI: 1.12-2.37, $p < 0.05$) compared to agriculture (Table 3). The incidence of a bladder cancer diagnosis was higher for both sexes in Quebec, British Columbia, Alberta and Nova Scotia in comparison to Ontario (Supplementary Tables S1 and S2).

Kidney Cancer

Overall incidence of kidney cancer was 4380 for men and 1900 for women. For men, univariate analysis (Supplementary Table S3) demonstrated all age categories to have higher incidence compared to 25-34 year olds, with exception of 85+ (likely due to smaller number of events). Level of education had a protective effect on the incidence (university vs. no high school, HR 0.78; 95% CI: 0.70-0.87, $p<0.0001$). Similar to men, older women had higher incidence in the univariate analysis (Supplementary Table S4). The widowed status in both sexes (which may be reflective of older age groups), had higher incidence compared to single status (Supplementary Tables S3 and S4). For women, higher education also had a pronounced decrease in incidence (university vs. no high school, HR 0.58; 95% CI: 0.48-0.71, $p<0.0001$). For both sexes, in comparison to Ontario, those from Nova Scotia had higher incidences of kidney cancer diagnosis while those from British Columbia had lower (Supplementary Tables S3 and S4).

Multivariate analysis showed that in comparison to agriculture, business (HR 1.38; 95% CI: 1.14-1.68, $p=0.001$) and transportation (HR 1.33; 95% CI: 1.11-1.59, $p=0.002$) had the greatest increase in incidence for men (Table 4). While health and social service was the only common industry to have increased incidence of kidney

Table 1: Observed counts of bladder, kidney and prostate cancer of the study cohort by sex, industry, age group, marital status, level of education, visible minority status, and province.

Variable	Bladder Cancer (n=8635)		Kidney Cancer (n=6285)		Prostate Cancer (n=35220)	
	n (%)	p-value	n (%)	p-value	n (%)	p-value
Sex		<.0001		<.0001		NA
Male	6970 (80.72)		4380 (69.69)		35220 (100)	
Female	1665 (19.28)		1900 (30.23)		NA	
Industry		<.0001		<.0001		<.0001
Agricultural	485 (5.62)		270 (4.30)		2365 (6.71)	
Fishing and trapping	55 (0.64)		35 (0.56)		225 (0.64)	
Logging and forestry	80 0.93)		60 (0.95)		365 (1.04)	
Mining and oil	155 (1.80)		95 (1.51)		695 (1.97)	
Manufacturing	1535 (17.78)		1040 (16.55)		6570 (18.65)	
Construction	715 (8.28)		490 (7.80)		3220 (9.14)	
Transportation	510 (5.91)		380 (6.05)		2330 (6.62)	
Communication	295 (3.42)		245 (3.90)		1520 (4.32)	
Wholesale trade	430 (4.98)		315 (5.01)		1800 (5.11)	
Retail	885 (10.25)		690 (10.98)		2785 (7.91)	
Finance	230 (2.66)		190 (3.02)		1010 (2.87)	
Real estate	225 (2.61)		125 (1.99)		865 (2.46)	
Business	475 (5.50)		350 (5.57)		2170 (6.16)	
Government	700 (8.11)		515 (8.19)		3325 (9.44)	
Education	535 (6.20)		380 (6.05)		2420 (6.87)	
Health and social services	500 (5.79)		490 (7.80)		1135 (3.22)	
Accomodation and food	305 (3.53)		230 (3.66)		690 (1.96)	
Other	520 (6.02)		380 (6.05)		1725 (4.90)	
Age Category yr.		<.0001		<.0001		<.0001
25-34	405 (4.69)		650 (10.34)		765 (2.17)	
35-44	1360 (15.75)		1585 (25.22)		5565 (15.80)	
45-54	2680 (31.04)		1980 (31.50)		12625 (35.85)	
55-64	3180 (36.83)		1670 (26.57)		12635 (35.87)	
65-74	840 (9.73)		355 (5.65)		3085 (8.76)	
75-84	160 (1.85)		40 (0.64)		510 (1.45)	
85+*	15 (0.17)				30 (0.09)	
Marital Status		<.0001		<.0001		<.0001
Single	710 (8.22)		675 (10.74)		2120 (6.02)	
Married	6545 (75.80)		4680 (74.46)		29260 (83.08)	
Divorced	1085 (12.57)		705 (11.22)		3195 (9.07)	
Widowed	295 (3.42)		220 (3.50)		650 (1.85)	
Education		<.0001		<.0001		<.0001
No Highschool	3785 (43.83)		2555 (40.65)		13200 (37.48)	
Highschool	2850 (33.01)		2160 (34.37)		11750 (33.36)	
P.S. Non-Uni	1035 (11.99)		820 (13.05)		3990 (11.33)	
University	970 (11.23)		750 (11.93)		6280 (17.83)	
Visible Minority		<.0001		<.0001		<.0001
No	8345 (96.64)		5915 (94.11)		32785 (93.09)	
Yes	290 (3.36)		370 (5.89)		2435 (6.91)	
Province		<.0001		<.0001		<.0001
Ontario	2680 (31.04)		2370 (37.71)		14960 (42.48)	
Newfoundland	145 (1.68)		135 (2.15)		605 (1.72)	
Prince Eduard Island	40 (0.46)		40 (0.64)		205 (0.58)	

Nova Scotia	285 (3.30)		250 (3.98)		1160 (3.29)	
New Brunswick	250 (2.90)		220 (3.50)		1035 (2.94)	
Quebec	2485 (28.78)		1470 (23.39)		5795 (16.45)	
Manitoba	340 (3.94)		305 (4.85)		1375 (3.90)	
Saskatchewan	395 (4.57)		245 (3.90)		1630 (4.63)	
Alberta	860 (9.96)		605 (9.63)		3705 (10.52)	
British Columbia	1140 (13.20)		630 (10.02)		4685 (13.30)	
Yukon	10 (0.12)		5 (0.08)		30 (0.09)	
Northwest Territories	5 (0.06)		10 (0.16)		35 (0.10)	
Age yr. median (mean)	54 (53)	<.0001	49 (49)	<.0001	53 (53)	<.0001
Income** median (mean)	30.8 (36.3)	<.0001	29.1 (34.4)	<.0001	37.0 (45.6)	<.0001

*For kidney cancer the 85+ group was grouped with the 75-84 due to low count.
**In thousands of Canadian dollars.

Table 2: Multivariate analysis of occupation exposure to bladder cancer in men.

Variable	Chi-Square	Pr>ChiSq	HR	95% CI HR
Industry (ref-Agriculture)				
Accommodation and food	8.97	0.003	1.39	1.10 – 1.58
Business	11.14	0.0008	1.29	1.11 – 1.50
Communication	3.63	0.06	1.17	1.00 – 1.39
Construction	5.56	0.02	1.17	1.03 – 1.33
Education	5.30	0.02	1.20	1.03 – 1.39
Finance	5.12	0.02	1.24	1.03 – 1.50
Fishing and trapping	5.22	0.02	1.42	1.05 – 1.93
Government	5.02	0.03	1.17	1.02 – 1.34
Health and social service	3.70	0.05	1.19	1.00 – 1.42
Logging and forestry	0.20	0.66	1.06	0.82 – 1.36
Manufacturing	14.90	0.0001	1.27	1.12 – 1.43
Mining and oil	4.40	0.04	1.23	1.01 – 1.50
Other	10.79	0.001	1.28	1.10 – 1.48
Real estate	9.69	0.002	1.34	1.12 – 1.62
Retail	14.47	0.0001	1.29	1.13 – 1.47
Transportation	4.33	0.04	1.16	1.01 – 1.33
Wholesale trade	11.40	0.0007	1.29	1.11 – 1.49

Table 3: Multivariate analysis of occupation exposure to bladder cancer in women.

Variable	Chi-Square	Pr>ChiSq	HR	95% CI HR
Industry (ref-Agriculture)				
Accommodation and food	2.25	0.1	1.27	0.93 – 1.75
Business	1.50	0.2	1.24	0.88 – 1.73
Communication	0.04	0.8	1.04	0.69 – 1.58
Construction	0.08	0.8	0.94	0.59 – 1.49
Education	0.02	0.9	1.02	0.75 – 1.39
Finance	0.43	0.5	0.89	0.61 – 1.23
Fishing/trapping/log/forestry*	0.20	0.7	0.81	0.31 – 2.08
Government	3.01	0.08	1.32	0.96 – 1.81
Health and social service	1.01	0.3	1.16	0.87 – 1.54
Manufacturing	0.30	0.6	1.09	0.80 – 1.48
Mining and oil	0.06	0.8	1.11	0.48 – 2.52
Other	0.45	0.5	1.11	0.81 – 1.51
Real estate	6.54	0.01	1.63	1.12 – 2.37
Retail	0.32	0.6	1.09	0.82 – 1.45
Transportation	1.55	0.2	1.32	0.85 – 2.03
Wholesale trade	0.50	0.5	1.15	0.78 – 1.70

Table 4: Multivariate analysis of occupation exposure with kidney cancer in men.

Variable	Chi-Square	Pr>ChiSq	HR	95% CI HR
Industry (ref-Agriculture)				
Accommodation and food	0.004	0.953	1.01	0.79 – 1.29
Business	10.56	0.001	1.38	1.14 – 1.68
Communication	3.67	0.06	1.23	1.00 – 1.51
Construction	3.65	0.06	1.18	1.00 – 1.41
Education	0.47	0.5	1.07	0.88 – 1.32
Finance	3.76	0.05	1.27	1.00 – 1.62
Fishing and trapping	0.86	0.4	1.21	0.81 – 1.81
Government	3.36	0.07	1.18	0.99 – 1.41
Health and social service	5.37	0.02	1.30	1.04 – 1.62
Logging and forestry	1.23	0.3	1.19	0.87 – 1.64
Manufacturing	4.19	0.04	1.18	1.01 – 1.39
Mining and oil	0.36	0.5	1.08	0.84 – 1.40
Other	2.12	0.1	1.16	0.95 – 1.42
Real estate	3.55	0.06	1.28	0.99 – 1.65
Retail	7.93	0.005	1.29	1.08 – 1.53
Transportation	9.66	0.002	1.33	1.11 – 1.59
Wholesale trade	3.63	0.06	1.21	1.00 – 1.47

cancer in both sexes, wholesale trade (HR 1.88; 95% CI: 1.32-2.68, p=0.0004) had the most significant effect in women (Table 5).

Prostate Cancer

In the study cohort, there were 35220 men with new diagnosis of prostate cancer. As anticipated with univariate analysis (Supplementary Table S5), increased age exponentially increased risk of prostate cancer diagnosis, with 75-84 year olds having highest risk of diagnosis compared to 25-34 year olds (HR 152.25; 95% CI: 135.39-171.21, p<0.0001). This was reflected with increased risk in married, divorced and widowed men compared to single men. Educated men had higher incidence of prostate cancer, likely due to increased screening. This presumable access to prostate-specific antigen (PSA) screening was further supported with higher income earners having increased incidence (HR 1.05; 95% CI: 1.04-1.06, p<0.0001) and lower diagnosis rated among visibile minorities (HR 0.78; 95% CI: 0.75-0.82, p<0.0001). New Brunswick (HR 1.15; 95% CI: 1.08-1.22, p<0.0001), Alberta (HR 1.05; 95% CI: 1.01-1.09, p=0.008) and Saskatchewan (HR 1.09; 95% CI: 1.03-1.15, p=0.003) residents had higher incidence rates of prostate cancer diagnosis compared to residents in Ontario. On the other hand, Quebec (HR 0.61; 95% CI: 0.59-0.63, p<0.0001), Manitoba (HR 0.92; 95% CI: 0.86-0.97, p=0.002), Newfoundland (HR 0.90; 95% CI: 0.83-0.98, p=0.01) and Northwest Territories (HR 0.65; 95% CI: 0.46-0.91, p=0.01) had lower diagnosis rates. Multivariate analysis showed a number of the industries to have a lower incidence compared to agriculture (Table 6), with the greatest effects seen in accommodation and food (HR 0.77; 95% CI: 0.70-0.84, p<0.0001), construction (HR 0.89; 95% CI: 0.84-0.94, p<0.0001), and retail (HR 0.89; 95% CI: 0.84-0.94, p<0.0001) industries.

DISCUSSION

Our data included the largest population-based cohort to investigate social indicators and cancer outcomes. The current study found that the numbers of events were higher for men compared to women for the bladder and kidney cancer and therefore, the analyses were done separately for each gender. There was heterogeneity within the diagnosis rate amongst the Canadian provinces, and this was accounted for in the multivariate analysis. For each of the GU malignancy, there were differences in occupational exposures and risk of diagnosis.

Table 5: Multivariate analysis of occupation exposure with kidney cancer in women.

Variable	Chi-Square	Pr>ChiSq	HR	95% CI HR
Industry (ref-Agriculture)				
Accommodation and food	3.04	0.08	1.33	0.97 – 1.84
Business	1.08	0.3	1.20	0.85 – 1.70
Communication	5.66	0.02	1.58	1.08 – 2.30
Construction	1.72	0.2	1.32	0.87 – 2.03
Education	0.11	0.7	1.06	0.77 – 1.46
Finance	0.03	0.9	1.03	0.72 – 1.47
Fishing and trapping	2.39	0.1	2.02	0.83 – 4.92
Government	2.18	0.1	1.28	0.92 – 1.77
Health and social service	4.21	0.04	1.36	1.01 – 1.83
Logging and forestry	4.30	0.04	2.27	1.05 – 4.94
Manufacturing	0.32	0.6	1.09	0.80 – 1.50
Mining and oil	1.70	0.2	1.60	0.79 – 3.25
Other	4.10	0.04	1.38	1.01 – 1.88
Real estate	0.64	0.4	1.19	0.78 – 1.82
Retail	1.79	0.2	1.23	0.91 – 1.65
Transportation	2.09	0.1	1.37	0.89 – 2.11
Wholesale trade	12.35	0.0004	1.88	1.32 – 2.68

Bladder cancer was recorded in older age groups and education seemed to be protective. There was consistent increased risk with both sexes in real estate industries. The most plausible explanation may be increased smoking within the real estate industry, as smoking is most consistently linked with bladder cancer [7,8]. In the United States working industry survey, real estate workers had a higher than average rate of smoking at 23% and lowest rate

Table 6: Multivariate analysis of occupation exposure with prostate cancer.

Variable	Chi-Square	Pr>ChiSq	HR	95% CI HR
Industry (ref-Agriculture)				
Accommodation and food	33.70	<0.0001	0.77	0.70 – 0.84
Business	1.82	0.2	0.96	0.90 – 1.02
Communication	0.33	0.6	1.02	0.95 – 1.09
Construction	16.77	<0.0001	0.89	0.84 – 0.94
Education	3.89	0.05	0.94	0.88 – 1.00
Finance	1.83	0.2	1.06	0.98 – 1.14
Fishing and trapping	0.96	0.3	1.07	0.93 – 1.24
Government	0.24	0.6	0.99	0.93 – 1.04
Health and social service	8.58	0.003	0.89	0.83 – 0.96
Logging and forestry	1.81	0.2	0.92	0.82 – 1.04
Manufacturing	7.81	0.005	0.93	0.88 – 0.98
Mining and oil	10.63	0.001	0.86	0.79 – 0.94
Other	5.86	0.02	0.92	0.86 – 0.99
Real estate	0.04	0.8	1.01	0.93 – 1.09
Retail	15.72	<0.0001	0.89	0.84 – 0.94
Transportation	4.12	0.04	0.94	0.88 – 1.00
Wholesale trade	4.89	0.03	0.93	0.87 – 0.99

of decline in smoking rates over the 2004-2012 period [11]. The same authors found a protective effect of level of education with declining smoking rates. This finding was replicated in our study. Thus, rather than specific occupational hazards, it is likely that the behaviour of workers within that profession is likely associated with higher bladder cancer diagnosis rates.

The incidence of diagnosis of kidney cancer has increased dramatically over the recent years, without a corresponding change in disease specific mortality [12]. This increased number of incidental small renal mass arises from greater access to medical imaging. In our study, we found that health and social service sector workers had increased diagnosis of kidney cancer for both sexes. This may be due to greater imaging of these workers as part of work up from other presentations. A similar theme was found in a Japanese case-control study, where male workers in higher management positions were more likely to be diagnosed with kidney cancer [13]. These workers are also more likely to have comprehensive routine medical work-up, exposing them to higher rates of medical imaging.

The current cohort found that the agriculture sector (which was the reference group) had the highest risk of prostate cancer diagnosis, when compared to other sectors. The univariate analysis found that income level, non-minority ethnicity and education level increased risk of diagnosis. This supports the notion of greater PSA screening in this population. The higher risk within the agriculture sector was also seen in an Ontario based study, whereby the farmers were at higher risk of diagnosis [4]. However, they did not find increased risk with farm, nursery and related workers. The PSA screening within Canada is largely dependent on the primary care physician and the individual patient. The perception of the primary care physician on the relative health status of the individual patient plays a great role in PSA screening. Age-matched farmers are likely to be in a better physical condition than their counterparts in a non-active industry. Having a life-expectancy less than 10 years was found to be the greatest contributor to primary care physicians stopping PSA testing in Canada [14]. This perception of a farmer being healthier may thus lead to greater PSA testing in this cohort.

Limitations of the CanCHEC database has been discussed previously [15]. This includes a selection bias, whereby the cohort participants have a lower mortality rate than the general population owing to socioeconomic factors. The participants were not disease-free at the start of the study, and only new diagnosis had to be included. More importantly, information on the risk factors for developing GU malignancy, especially smoking were not available. Furthermore, only ICD-9 or 10 diagnosis codes were used to classify new diagnosis of malignancy. The information accuracy is dependent on the accuracy data collection and reporting in the survey. The rate of diagnosis of a GU malignancy may have little impact on disease-specific mortality. These papers' results can only associate the diagnosis rate with a particular occupation after accounting for several socio-economic factors.

CONCLUSION

In conclusion, there were several occupational associations for the GU malignancy. Common to both genders were real estate for bladder cancer; and health and social service for kidney cancer. Prostate cancer was most commonly diagnosed in the agriculture sectors.

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Institutional Review Board Statement

Ethical review and approval were waived for this study; Research Data Canada exempt from IRB approval.

Informed Consent Statement

Patient consent was waived due to the study's retrospective nature, and since all the data analysis was deidentified.

Data Availability Statement

Restrictions apply to the availability of these data. Data was obtained from Statistics Canada and are available through Statistics Canada's Research Data Centres with the permission of Statistics Canada.

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CONFLICTS OF INTERESTS

The authors declare no conflict of interest.

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