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INTRODUCTION

Seasonal influenza vaccination among cancer patients is recommended. There is concern disease- or treatment-associated immunosuppression may decrease vaccine effectiveness (VE)

Objective: to evaluate VE against laboratory-confirmed influenza hospitalization among cancer patients

METHODS

An observational test-negative design study was performed using provincial health administrative and laboratory data linked at the Institute for Clinical Evaluative Sciences (ICES)

The study included previously diagnosed cancer patients aged ≥18 years of age who were hospitalized and tested for influenza during the 2010-11 to 2013-14 influenza seasons in Ontario, Canada

Influenza vaccination was determined through physician and pharmacist billing claims

Multivariable logistic regression was used to estimate VE, adjusting for age, sex, rurality, neighborhood income, cancer characteristics, chemotherapy exposure, comorbidities, previous health care use, influenza season and month of influenza testing

RESULTS

Table 1: Patient Demographics (n=10,052)

Characteristic	Number	Percentage
Influenza cases, n (%)		
Yes	1294	12.9
No	8758	87.1
Influenza vaccination, n (%)		
Yes	4578	45.5
No	5474	54.5
Age, n (%)		
18-65	3108	30.9
66-75	2425	24.1
76-85	2793	27.8
≥80	1726	17.2
Gender, n (%)		
Male	4686	46.6
Female	5366	53.4
Cancer Type, n (%)		
Solid tumour malignancy	8243	82.0
Hematologic malignancy	1784	17.7
Both	25	0.3
Cancer stage at diagnosis, n (%)		
Early stage (I-III)	2254	22.4
Late stage (IV)	859	8.5
Time since cancer diagnosis, years, mean (SD)	6.4 (0.8)	
Chemotherapy exposure, n (%)		
Active chemotherapy	2212	22.0
Previous chemotherapy	1126	11.2
No chemotherapy	6714	66.8
Medical co-morbidities, n (%)		
Anemia	3944	39.2
Ischemic heart disease	2907	28.9
Arrhythmia	2371	23.6
Congestive heart failure	3299	32.8
Asthma	2486	24.7
COPD	4439	44.2
Diabetes	3699	36.8
Renal Disease	1969	19.6
Immunodeficiency	2957	29.4
Dementia	782	7.8
Stroke	724	7.2
No. of hospitalizations within past 3 years, mean (SD)	2.1 (2.5)	
No. of physician office visits within past 1 years, mean (SD)	19.3 (13.4)	
Receipt of home care services, n (%)		
Yes	5530	55.0
No	4522	45.0
Month of influenza test, n (%)		
November	334	3.4
December	1751	17.4
January	2567	25.5
February	1740	17.3
March	1742	17.3
April	1333	13.3
May	575	5.7

RESULTS

Table 2: Crude and adjusted influenza vaccine effectiveness estimates among hospitalized cancer patients during the 2010-20011 to 2013-2014 influenza seasons in Ontario, Canada

Outcome	Test-positive patients No. Vaccinated / Total (%)	Test-negative patients No. Vaccinated / Total (%)	Unadjusted VE, % (95% CI)	Adjusted VE, % (95% CI)
Hospitalization	528/1294 (40.8)	4050/8758 (46.2)	20 (10, 29)	25 (15, 34)
Hospitalization requiring ICU admission	101/248 (40.7)	874/1935 (45.2)	17 (-9, 36)	23 (-4, 42)
Hospitalization and death within 90 days	87/217 (40.1)	906/2161 (41.9)	7 (-23, 30)	18 (-12, 40)
Subgroup analysis by chemotherapy exposure				
Active chemotherapy	86/261 (33.0)	653/1951 (33.5)	2 (-29, 26)	6 (-27, 31)
Previous chemotherapy	67/172 (39.0)	407/954 (42.7)	14 (-20, 39)	30 (-2, 52)
No chemotherapy	375/861 (43.6)	2990/5853 (51.1)	26 (15, 36)	29 (17, 39)
Subgroup analysis by tumour type and chemotherapy exposure				
Solid tumour - Active chemotherapy	48/166 (28.9)	420/1318 (31.9)	13 (-24, 39)	17 (-23, 43)
Solid tumour - †No active chemotherapy	375/881 (42.6)	2955/5878 (50.3)	27 (15, 37)	31 (19, 40)
Hematologic - Active chemotherapy	38/95 (40.0)	233/633 (36.8)	-14 (-78, 26)	-19 (-99, 29)
Hematologic - †No active - chemotherapy	67/152 (44.1)	442/929 (47.6)	13 (-23, 39)	10 (-33, 39)

†No active chemotherapy includes both previous and no chemotherapy

RESULTS

We identified 10,052 hospitalized cancer patients who underwent influenza testing, with 1249 (12.9%) test-positive cases and 4578 (45.5%) vaccinated. Mean age was 71.3 years, 46.6% were male, mean time since diagnosis was 6.4 years, 82.0% had a solid tumour malignancy, 22.0% were receiving active chemotherapy, and 11.2% had previous chemotherapy exposure. The overall adjusted VE (aVE) against laboratory-confirmed influenza hospitalization was 25% (95% CI, 15%, 34%). Additionally, the observed aVE rate among patients receiving active chemotherapy was 6% (95% CI: -27%, 31%), compared with 30% (95% CI: -2%, 52%) among patients who previously received chemotherapy, and 29% (95% CI: 17%, 39%) among patients who had never received chemotherapy.

In patients with solid tumour malignancies, the aVE rate among patients receiving active chemotherapy was 17% (95% CI: -23, 43) compared with 31% (95% CI: 19, 40) among patients not receiving active chemotherapy (previous chemotherapy or no chemotherapy). In patients with hematologic malignancies, the aVE rate among patients receiving active chemotherapy was -19% (95% CI -99, 29), compared with 10% (95% CI: -33, 39) among patients not receiving active chemotherapy.

CONCLUSIONS

Overall, our results support general recommendations for influenza vaccination among cancer patients and survivors, but vaccine effectiveness among cancer patients who are actively undergoing chemotherapy is uncertain and warrants further study.

There is also a trend towards decreased influenza vaccine effectiveness among patients with hematologic malignancies, especially those receiving active chemotherapy.

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