Table S1. Data Sources integrated within the British Columbia COVID-19 Cohort (BCC19C)

British Columbia Centre for Disease Control (BCCDC), Provincial Heath Services Authority (PHSA) and Regional Health Authority data sources:	**Data Date Ranges:**
- Provincial Immunizations Registry (COVID-19 vaccination data) [S1]	Dec,2020-onward
- Public Health Reporting Data warehouse (Influenza laboratory tests) [S2]	Jan,2008-onward
Ministry of Health (MoH) Administrative Data Sources:	
- Discharge Abstracts Database (DAD) (hospital discharge records) [S3]	2008/9-onward
- BC Vital Statistics (VS) (deaths registry)[S4]	2008/9-onward
- Chronic Disease Registry [S5]	2008/9-2018/19

Supplementary References:

S1. Provincial Health Services Authority [creator]. COVID-19 vaccination data. Provincial Immunizations Registry, Provincial Public Health Information Systems [publisher]. (2020). 2021.

S2. British Columbia Centre for Disease Control [creator]. Respiratory datamart, Public Health Reporting Data Warehouse, British Columbia Centre for Disease Control [publisher] (2020). 2021.

S3. British Columbia Ministry of Health [creator]. Discharge Abstract Database (Hospital Separations). British Columbia Ministry of Health [publisher]. Data Extract. MOH (2020). 2021. (https://www2.gov.bc.ca/gov/content/health/health-forms/online-services)

S4. BC Vital Statistics Agency [creator]. Vital Statistics Deaths. BC Vital Statistics Agency [publisher]. Data Extract. BC Vital Statistics Agency (2020). 2021. https://www2.gov.bc.ca/gov/content/health/health-forms/online-services

S5. British Columbia Ministry of Health [creator]. Chronic Disease Registry. British Columbia Ministry of Health [publisher]. Data Extract. MOH (2020). 2020. https://www2.gov.bc.ca/gov/content/health/health-forms/online-services

Table S2. Variables of interest of the study

Variables	Definition/Categories
Age	Age (years) was categorized into 0-4, 5-11, 12-17, 18-29, 30-39, 40-49, 50-59, 60-69, and 70+ years old
Sex	Sex was categorized into Male, Female, Unknown
Health authority of residence	British Columbia has five regional health authorities that deliver health services to meet the needs of the population within their respective geographic regions: Fraser, Vancouver Coastal, Vancouver Island, Interior, and Northern. Missing health authority was categorized as "Unknown".
Admission date	Date of hospital admission
Discharge date	Date of hospital discharge
Vaccine status for COVID-19 peak analysis	Vaccine status was categorized into Fully vaccinated, Vaccinated with 1 dose (or partially vaccinated) and Unvaccinated. Fully vaccination was defined as receipt of two or more doses in which the second dose was received ≥14 days before admission date. Partially vaccinated cases were those who became a case ≥21 days after their first dose and did not meet the criteria of fully vaccinated. Unvaccinated cases were those without any doses or those cases within <21 days after their first dose. In the hospitalization rates for the peak analysis, partially vaccinated cases were only included for the children 5-11 years old and excluded from 12+ cases due to small sample size. Children aged 0-4 were not eligible for COVID-19 vaccination during study period.
Length of stay in hospital	Length of stay in the hospital was generated by subtracting discharge date from admission date within one episode of hospitalization. If transferred to different facility, the last discharge date was subtracted from the first admission date.
Comorbidity	Comorbidity was derived from Chronic Disease Registry database which has 26 conditions defined based on validated algorithm. Patients were categorised into 3 categories of 0-1, 2-3, 4+ number of comorbidities based on incidence dates before admission dates. Because mood and anxiety disorder was one of the condition with high incidence in the population we starts the categories with 0-1 condition. The conditions include Alzheimer's disease and other dementia, Acute Myocardial Infarction, Angina, Asthma, Chronic Kidney Disease, Chronic Obstructive Pulmonary Disease, Depression, Diabetes, Epilepsy, Gout, Hospitalized Stroke, Hospitalized Haemorrhagic Stroke, Hospitalized Ischemic Stroke, Hospitalized Transient Ischemic Attack, Heart Failure, Hypertension, Ischemic Heart Disease, Juvenile Idiopathic Arthritis, Mood and Anxiety Disorder, Multiple Sclerosis, Osteoarthritis, Osteoporosis, Parkinson's/Parkinsonism, Rheumatoid Arthritis, Schizophrenia, Substance misuse

Stay in Intensive Care Unit (ICU)	DAD database provides number of days in ICU for each episode of admission which was used to calculate ICU admission and number of days in ICU.
In-hospital death	In-hospital death was captured when death date was equal to discharge date. This variable was used for sensitivity analysis of patient's outcome while excluding in-hospital death.

Table S3: Baseline characteristics of patients hospitalized primarily for COVID-19 during a year in 2020/21 and for influenza in 2009/10 (H1N1 pandemic), 2015/16 (higher severity in children), and 2016/17 (higher severity in adults), British Columbia, Canada

Characteristics	**COVID_19 (n=3,097)**	**Influenza 2009/10 (n=1,560)**	**Influenza 2015/16 (n=1,057)**	**Influenza 2016/17 (n=2,025)**
	n (%)	n (%)	n (%)	n (%)
Sex				
Female	1294 (42)	837 (54)	529 (50)	1065 (53)
Male	1803 (58)	723 (46)	528 (50)	959 (47)
Unknown	0 (0)	0 (0)	0 (0)	<5
p value	*Ref*	*<0.0001*	*<0.0001*	*<0.0001*
Age, years, Median (Q1-Q3)	67 (54-78)	39 (15-55)	59 (33-75)	76 (60-86)
p value	*Ref*	*<0.0001*	*<0.0001*	*<0.0001*
Age groups, years				
0-4	21 (1)	205 (13)	110 (10)	72 (4)
5-11	8 (0)	142 (9)	54 (5)	30 (1)
12-17	5 (0)	75 (5)	28 (3)	24 (1)
18-29	83 (3)	210 (13)	49 (5)	41 (2)
30-39	192 (6)	152 (10)	77 (7)	74 (4)
40-49	297 (10)	227 (15)	83 (8)	79 (4)
50-59	466 (15)	250 (16)	140 (13)	173 (9)
60-69	645 (21)	127 (8)	158 (15)	265 (13)
70+	1380 (45)	172 (11)	358 (34)	1267 (63)
p value	*Ref*	*<0.0001*	*<0.0001*	*<0.0001*
Health authority				
Fraser	1491 (48)	488 (31)	268 (25)	457 (23)
Vancouver Coastal	778 (25)	289 (19)	328 (31)	650 (32)
Vancouver Island	121 (4)	239 (15)	233 (22)	608 (30)
Interior	293 (9)	372 (24)	145 (14)	227 (11)
Northern	358 (12)	158 (10)	67 (6)	63 (3)
Unknown	56 (2)	14 (1)	16 (2)	20 (1)
p value	*Ref*	*<0.0001*	*<0.0001*	*<0.0001*
Number of comorbidities				
0-1	691 (22)	714 (46)	343 (32)	316 (16)
2-3	809 (26)	364 (23)	229 (22)	394 (19)
4+	1597 (52)	482 (31)	485 (46)	1315 (65)
p value	*Ref*	*<0.0001*	*<0.0001*	*<0.0001*

Abbreviation: COVID-19=Coronavirus Disease 2019, Q= Quartile, NA=Not Applicable, Ref=Reference.

Note: For annual COVID-19 cohort we included all patients hospitalized primarily for COVID-19 from March 2020 to February 2021. For influenza, we selected three 12-month periods from September to August of each year.

Table S4: Outcome of patients hospitalized for COVID-19 *during a year in 2020/21 and for influenza in 2009/10 (H1N1 pandemic), 2015/16 (higher severity in children), and 2016/17 (higher severity in adults), by age group, British Columbia, Canada*

Outcome by age groups (year)	**COVID_19 (n=3,097)**	**Influenza 2009/10 (n=1,560)**	**Influenza 2015/16 (n=1,057)**	**Influenza 2016/17 (n=2,025)**
Hospital length of stay, days, Median (Q1-Q3)				
All ages	8 (4-17)	3 (2-7)	5 (3-10)	6 (3-12)
P value	*Ref*	*<0.0001*	*<0.0001*	*<0.0001*
0-4	2 (1-3)	2 (1-4)	3 (2-6)	3 (1-5)
5-11	3 (2-10)	2 (1-5)	3 (2-7)	3 (1-7)
12-17	7 (2-15)	2 (1-5)	2 (1-4)	3 (2-9)
18-29	5 (2-9)	2 (1-4)	3 (1-5)	2 (1-3)
30-39	5 (3-9)	3 (1-5)	3 (2-8)	3 (1-5)
40-49	6 (3-11)	4 (2-8)	4 (2-9)	4 (2-7)
50-59	7 (4-13)	5 (2-9)	7 (3-13)	4 (2-8)
60-69	9 (5-18)	5 (2-10)	6 (3-11)	5 (3-11)
70+	11 (6-20)	5 (2-11)	7 (4-12)	7 (4-14)
Admission to ICU				
All ages	1013 (33%)	231 (15%)	221 (21%)	239 (12%)
P value	*Ref*	*<0.0001*	*<0.0001*	*<0.0001*
0-4	5 (0%)	13 (6%)	21 (10%)	20 (8%)
5-11	<5	15 (6%)	9 (4%)	8 (3%)
12-17	<5	6 (3%)	<5	7 (3%)
18-29	20 (2%)	26 (11%)	12 (5%)	6 (3%)[μ]
30-39	61 (6%)	24 (10%)	12 (5%)	
40-49	99 (10%)	45 (19%)	22 (10%)	14 (6%)
50-59	165 (16%)	57 (25%)	49 (22%)	33 (14%)
60-69	260 (26%)	27 (12%)	46 (21%)	56 (23%)
70+	398 (39%)	18 (8%)	46 (21%)	95 (40%)
Stay in ICU, days, Median (Q1-Q3)				
All ages	8 (4-16)	6 (2-14)	6 (3-13)	5 (3-11)
P value	*Ref*	*<0.0001*	*<0.0001*	*<0.0001*
0-4	1 (1-2)	4 (1-13)	3 (2-6)	5 (2-11)
5-11	Sup[*]	2 (1-5)	3 (1-10)	4 (1-20)
12-17	Sup[*]	4 (2-7)	Sup[*]	4 (2-7)
18-29	6 (3-14)	4 (2-22)	4 (2-21)	5 (2-31)[μ]
30-39	5 (3-13)	4 (1-6.5)	9 (2-14)	
40-49	6 (3-11)	11 (4-24)	9 (4-12)	3 (2-8)
50-59	8 (3-17)	7 (4-13)	8 (6-12)	6 (4-12)
60-69	10 (5-19)	7 (3-13)	9 (4-16)	8 (3-12)

Outcome by age groups (year)	COVID_19 (n=3,097)	Influenza 2009/10 (n=1,560)	Influenza 2015/16 (n=1,057)	Influenza 2016/17 (n=2,025)
70+	9 (4-17)	7.5 (3-11)	4.5 (3-10)	6 (3-9)

Abbreviation: COVID-19=Coronavirus Disease 2019, ICU=Intensive Care Unit, Q= Quartile, Ref=Reference.

Note: For annual COVID-19 cohort we included all patients hospitalized primarily for COVID-19 from March 2020 to February 2021. For influenza, we selected three 12-month periods from September to August of each year. P values are presenting differences between COVID-19 and each influenza year.

*Suppressed due to disclosure control.

µThe 2 age groups collapsed due to disclosure control.

Table S5: Validation of ICD-10 algorithms against lab-confirmed hospitalization to identify hospitalized individuals with seasonal influenza infection residing in Vancouver Coastal Health region of British Columbia, Canada

Characteristics	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95%CI)	NPV (95%CI)
Influenza 2009/10	148	113	20	471	88 (82, 93)	81 (77, 84)	57 (52, 61)	96 (94, 97)
Influenza 2015/16	174	6	75	777	70 (64, 76)	99 (98, 100)	97 (93, 98)	91 (90, 93)
Influenza 2016/17	382	55	130	1269	75 (71, 78)	96 (95, 97)	87 (84, 90)	91 (88, 91)

Abbreviation: CI=Confidence Interval, FN=False Negative, FP=False Positive, ICD-10=International Classification of Disease 10th edition, NPV=Negative Predictive Value, PPV=Positive Predictive Value, TN=True Negative, TP=True Positive
Note: We selected the 10-week peak in each influenza season.

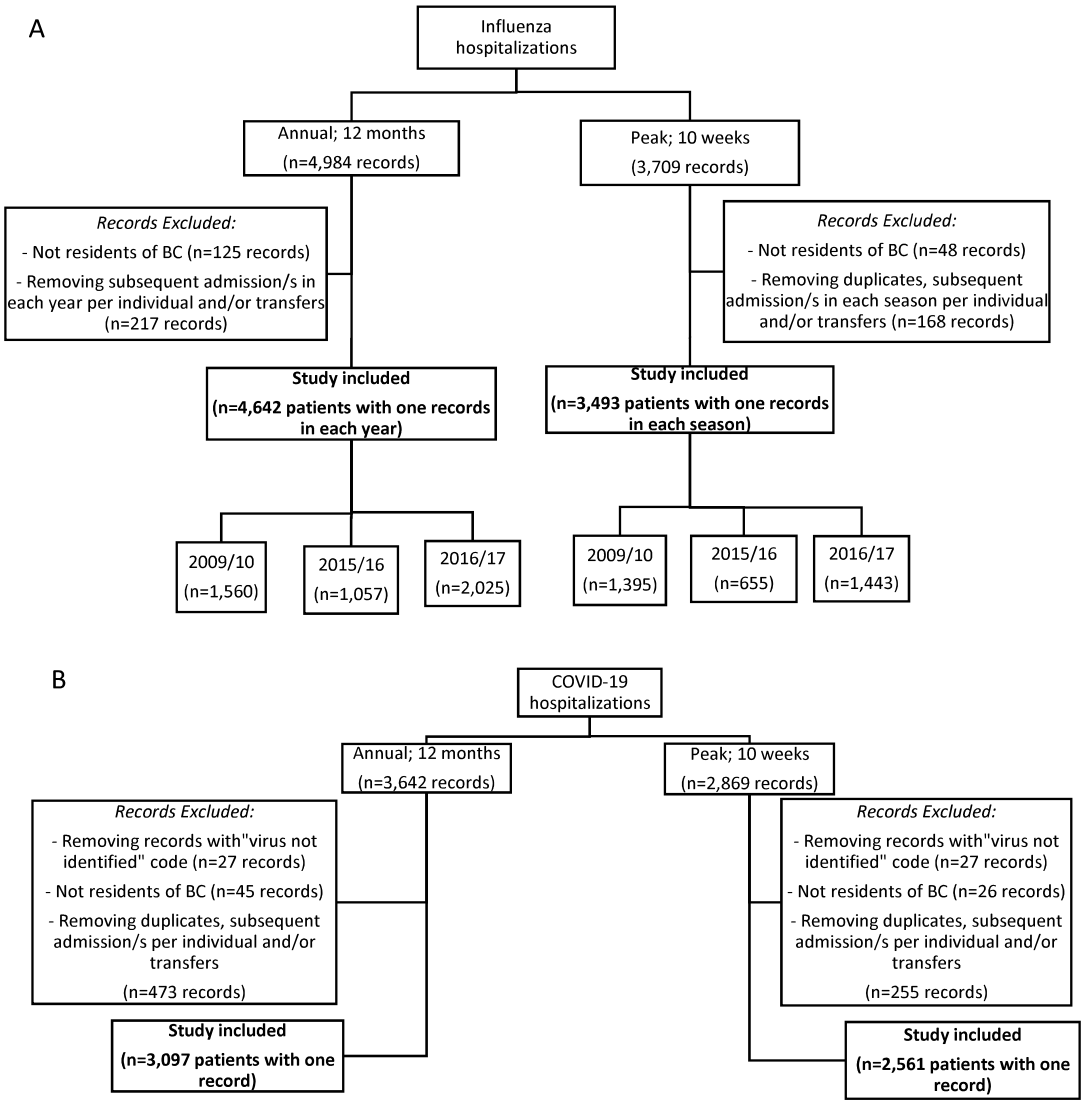


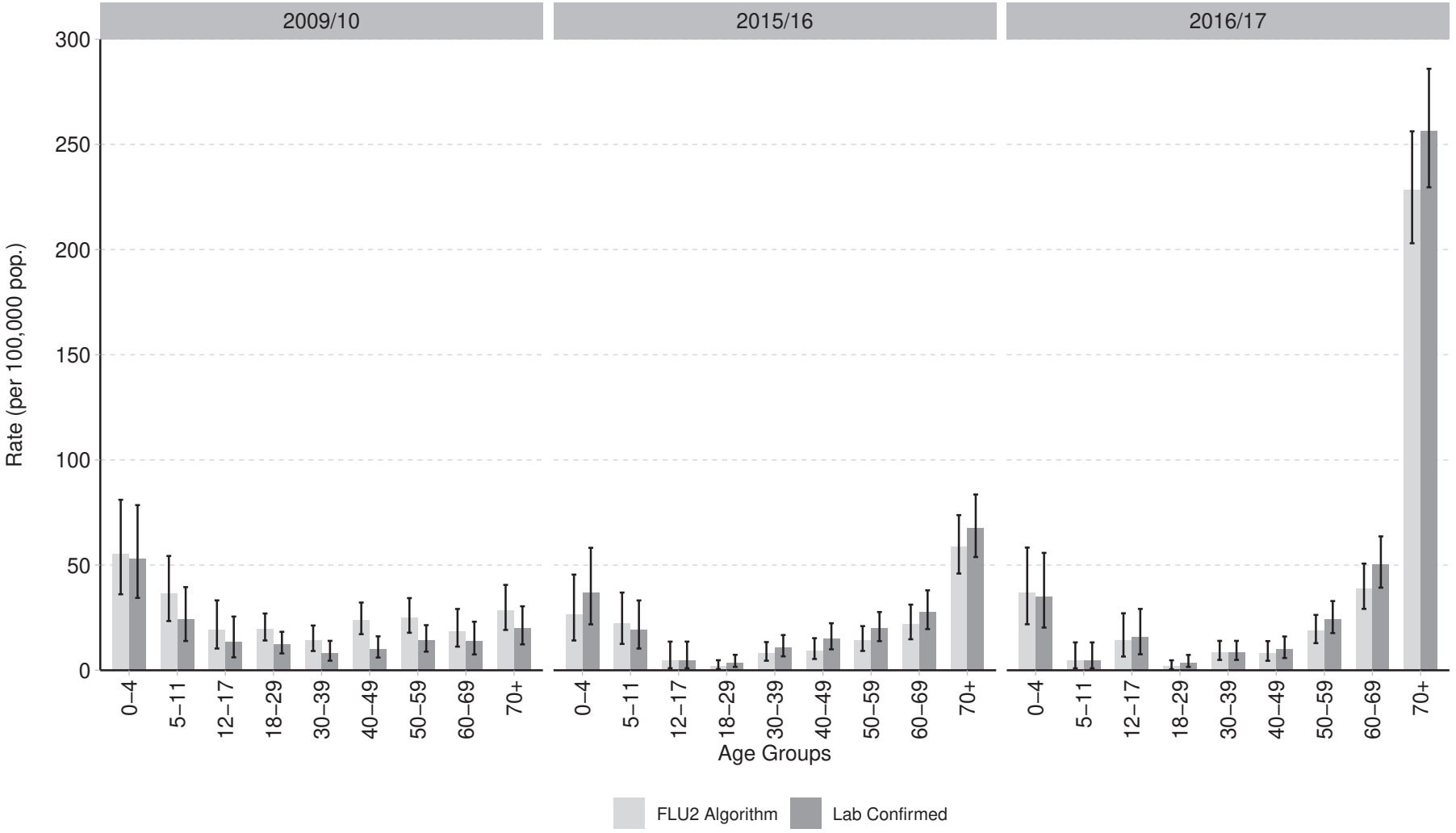
Figure S1: Annual and Peak study cohorts for influenza and COVID-19 hospitalization.

Note: A) For the annual influenza analysis we selected hospitalized pateints from three 12-month period, September to August, of three years with distinct characteristics: 2009/10= H1N1 pandemic, 2015/16= higher severity in children, 2016/17= higher severity in adults. For peak analysis we selected data-driven 10-week peak from each year. B) For the annual COVID-19 cohort, we included all patients hospitalized for COVID-19 from March 2020 to February 2021. For the peak COVID-19 cohort, we included all patients hospitalized for COVID-19 during the first Omicron wave in January and February 2022 in the context of >90% of adults in British Columbia being vaccinated with at least 2 doses.

Figure S2: Population rate of patients hospitalized for COVID–19 during the first 10 weeks of 2022 (Omicron era) and for influenza, the 10–week peak of 2009/10 (H1N1 pandemic), 2015/16 (higher severity in children), and 2016/17 (higher severity in adults), by age group, British Columbia, Canada

Note: For the peak COVID–19 cohort we included all patients hospitalized for COVID–19 during the first 10 weeks of 2022 when Omicron was dominant and >90% of adults in British Columbia were vaccinated with at least 2 doses. For influenza peak analysis, we selected data–driven 10–week peak from each season during which the majority of all hospitalized cases of the year were admitted.

Figure S3:Lab−confirmed versus ICD code−identified (FLU2 algorithm) influenza hospitalization rates during the peak (10 weeks) of 2009/10 (H1N1 pandemic), 2015/16 (severe for children), and 2016/17 (severe for adults), by age group among the residents of Vancouver Coastal Health, British Columbia, Canada



Note: We selected the 10−week peak of seasons with distinct characteristics: 2009/10=H1N1 pandemic, 2016/17=higher severity in adults,2015/16=higher severity in children.