

APPENDIX 1: Data sources and the Codes in Details:

Data Source	Codes	Details
1. DAD	ICD-10-CA for comorbidities ⁷⁰	Type: DXCODE1 - DXCODE 25
	ICD-10-CA for ICU admission	Any SCU code other than 90, 93, 95, 98, or 99
	ICD-10-CA for influenza-like illness	B97.89, H66.9, J00, J01, J06, J09, J10, J11, J12, J18, J20, J21, J22, R05, R50.9
	ICD-10-CA for CV-ICU admission	SCU codes equal to 40 or 45
	Ventilation admission	CCI code equal to 1. GZ.31
	CCI Procedure codes	PROCCODE1 - PROCCODE 20
2- AHCIP	ICD9 for comorbidities	HLTH_DX_ICD9x_CODE_1 HLTH_DX_ICD9x_CODE_2 HLTH_DX_ICD9x_CODE_3

APPENDIX 2: The comparison of the data with and without balancing class methods (ROTE and SMOTE) in terms of ORs (95% CI) and P-values by using a univariate logistic regression.

	Initial Data		Balanced with ROTE		Balanced with SMOTE	
	OR	P-Value	OR	P-Value	OR	P-Value
Age category						
80+	1[Reference]		1[Reference]		1[Reference]	
70-79	0.61	0.00	0.62	0.00	0.62	0.00
60-69	0.45	0.00	0.47	0.00	0.47	0.00
50-59	0.20	0.00	0.20	0.00	0.20	0.00
40-49	0.1	0.00	0.09	0.00	0.09	0.00
30-39	0.19	0.00	0.23	0.00	0.23	0.00
18-29	0.32	0.18	0.24	0.00	0.24	0.00
Age (continuous)	1.04	0.00	1.04	0.00	1.04	0.00
Gender						
Male	1.40	0.00	1.41	0.00	1.40	0.00
Female	1[Reference]		1[Reference]		1[Reference]	
Specimen Collection location						
Long-term Care	1[Reference]		1[Reference]		1[Reference]	
Designated Supported Living	0.42	0.00	0.43	0.00	0.43	0.00
Emergency Department	3.09	0.00	3.09	0.00	3.27	0.00
Hospital	2.33	0.00	2.51	0.00	2.4	0.00
Resident During Collection						
Long Term Care	1[Reference]		1[Reference]		1[Reference]	
Designated Supported Living	0.49	0.00	0.5	0.00	0.51	0.00
Symptomatic During Collection						
No	1[Reference]		1[Reference]		1[Reference]	
Yes	2.33	0.00	2.37	0.00	2.37	0.00

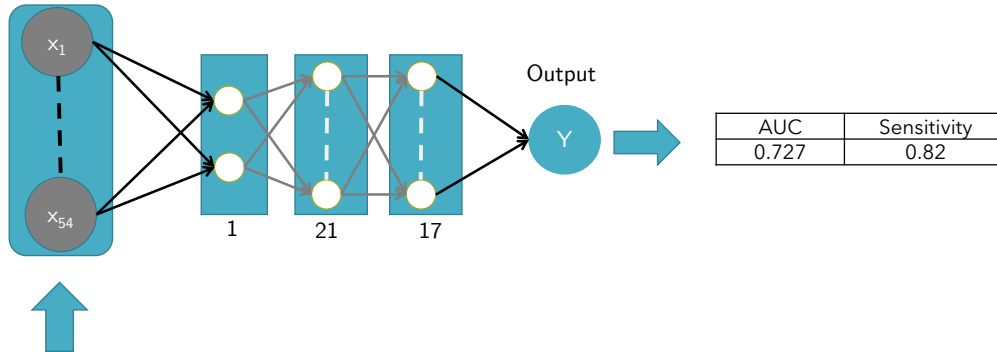
Unknown	2.02	0.00	1.99	0.00	1.99	0.00
Result of the covid test						
Negative	1[Reference]		1[Reference]		1[Reference]	
Positive	4.25	0.00	4.24	0.00	4.17	0.00
Specimen year-month collection						
2020-3 (original variant)	6.25	0.00	6.42	0.00	6.42	0.00
2020-4 (alpha)	4.01	0.00	4.13	0.00	4.13	0.00
2020-5	3.59	0.00	3.69	0.00	3.69	0.00
2020-6	1[Reference]		1[Reference]		1[Reference]	
2020-7	3.56	0.00	3.51	0.00	3.51	0.00
2020-8	2.48	0.00	2.34	0.00	2.34	0.00
2020-9	3.12	0.00	3.18	0.00	3.18	0.00
2020-10 (Delta)	4.39	0.00	4.41	0.00	4.41	0.00
2020-11	5.40	0.00	5.64	0.00	5.64	0.00
2020-12 (Beta)	5.55	0.00	5.77	0.00	5.77	0.00
2021-1 (Gamma)	6.4	0.00	6.22	0.00	6.22	0.00
2021-2 (Theta)	2.945	0.00	3.27	0.00	3.27	0.00
2021-3	1.86	0.05	1.94	0.00	1.94	0.00
Year-month collection Continuous	1.08	0.00	1.07	0.00	1.07	0.00
Num of Elixhauser Category						
1+	1[Reference]		1[Reference]		1[Reference]	
0	1.05	0.53/0.53	1.07	0.05	1.04	0.29
Elixhauser features for 2 years						
Elixhauser index	1.03	0.00	1.03	0.00	1.03	0.00
Num of Elixhauser	1.05	0.00	1.05	0.00	1.05	0.00
Num of Admits for 1 year						
Hospital	1.12	0.00	1.12	0.00	1.12	0.00
SCU	1.21	0.13	1.22	0.00/0.00	1.24	0.00
Num Procedures for 1 year						
DAD	1.04	0.01	1.04	0.00	1.04	0.00
NACRS	1.00	0.47	1.00	0.55	1.00	0.04
Comorbidities						
Hypertension, uncomplicated	0.97	0.53	1.0	0.82	0.97	0.13
Depression	0.84	0.00	0.84	0.00	0.83	0.00
Other neurological disorders	1.00	0.99	0.99	0.58	0.99	0.75
Diabetes	1.12	0.01	1.12	0.00	1.13	0.00
Rheumatoid arthritis/ collagen vascular diseases	0.95	0.24	0.95	0.00	0.95	0.01
Psychoses	1.1	0.05	1.08	0.00	1.07	0.00
Fluid and electrolyte disorders	1.47	0.00	1.48	0.00	1.49	0.00
Cardiac arrhythmias	1.36	0.00	1.36	0.00	1.36	0.00
Chronic pulmonary disease	1.32	0.00	1.33	0.00	1.32	0.00
Congestive heart failure	1.6	0.00	1.62	0.00	1.62	0.00

Renal failure	1.33	0.00	1.30	0.00	1.32	0.00
Liver disease	1.24	0.07	1.15	0.01	1.23	0.01
Metastatic cancer	1.92	0.00	1.91	0.00	1.87	0.00

APPENDIX 3: The architecture and the results for the ANN model

ANN

Input Data



Normalized Data (Power Transformation Method)
Balanced Classes (Random Over-Sampling Technique)

Appendix 4: The hyperparameters for each ML mode

Model	Optimum hyperparameters	Experimented hyperparameters	# Trials
RF	bootstrap= 'TRUE' max_depth= 10 max_features= 'sqrt' min_samples_leaf= 8 min_samples_split= 10 n_estimators= 600 criterion= 'entropy'	bootstrap= ('True', 'False') max_depth= (10, 20, 30, 40, 50, 60, 70, 80, 90, 100) max_features= ('auto', 'sqrt', 'log2') min_samples_leaf= (1, 2, 4, 8) min_samples_split= (2, 5, 10) n_estimators= (400, 600, 800, 1000, 1200, 1400, 1600, 1800, 2000) criterion= ('gini', 'entropy')	12,960
SVM	C= 1000, Gamma= 0. 0001, Kernel= 'sigmoid'	C= (0.1, 1., 10., 100., 1000., 1200., 1300., 1400., 1500., 2000., 3000) gamma= (0.000001, 0.00001, 0.0001, 0.001, 0.01, 0.1, 1.0 ,10.0, 100.0, 'scale', 'auto') kernel= ('rbf' 'poly' 'sigmoid')	396

XGBoost	subsample=0.7 n_estimators=1000 max_depth=1000 learning_rate=0.01 colsample_bytree=0.5 colsample_bylevel=0.6	subsample= (0.7, 0.8, 0.9) n_estimators= (100, 500, 1000) max_depth= (3, 5, 6, 10, 15, 20) learning_rate= (0.01, 0.1, 0.2, 0.3, 0.4) colsample_bytree= (0.4, 0.5, 0.6, 0.7, 0.8, 0.9) colsample_bylevel= (0.4, 0.5, 0.6, 0.7, 0.8, 0.9)	9,720
ANN (1 layer)	hidden_layer_sizes= (2,) max_iter= 100 activation= 'logistic' solver= 'lbfgs' alpha= 0.001 learning_rate= 'adaptive'	hidden_layer_sizes= (1 - 32) max_iter= (50, 100, 150, 1000) activation= ('tanh', 'relu', 'logistic') solver= ('sgd' 'adam' 'lbfgs') alpha= (1e-5, 0.00001, 0.0001, 0.001, 0.01, 0.05) learning_rate= ('constant', 'adaptive')	13,824
ANN (2 layers)	hidden_layer_sizes= (1, 14) max_iter= 1000000 activation= 'relu' solver= 'lbfgs' alpha= 0.05 learning_rate= 'adaptive'	hidden_layer_sizes_1= (1 - 32) hidden_layer_sizes_2= (1 - 32) max_iter= (1000000) activation= ('tanh', 'relu', 'logistic') solver= ('sgd' 'adam' 'lbfgs') alpha= (1e-5, 0.00001, 0.0001, 0.001, 0.01, 0.05) learning_rate= ('constant', 'adaptive')	110,592
ANN (3 layers)	hidden_layer_sizes= (1, 21, 17) max_iter= 1000000 activation= 'relu' solver= 'lbfgs' alpha= 1e-5 learning_rate= 'adaptive'	hidden_layer_sizes_1= (1 - 32) hidden_layer_sizes_2= (1 - 32) hidden_layer_sizes_3= (1 - 32) max_iter= (1000000) activation= ('relu') solver= ('lbfgs') alpha= (1e-5) learning_rate= ('adaptive')	32,768

Appendix 5: Packages of the Python programming language used in this study.

#	Package
1	Pandas
2	Numpy
3	Sklearn
4	Imblearn
5	Os
6	Sys

Appendix 6: The most prevalent comorbidities of continuing care residents in Alberta who were confirmed tested positive or negative with a Covid-19 infection between, March 1, 2020, to March 31, 2021.

Comorbidities				
Num of Elixhauser Category	1+	2406 (92.9)	21432 (93.22)	23838 (93.19)
	0	184 (7.1)	1558 (6.78)	1558 (6.81)
Hypertension, uncomplicated		1307 (50.46)	11751 (51.11)	13058 (51.05)
Depression		1121 (43.28)	10922 (47.51)	12043(47.08)
Other neurological disorders		1060 (40.93)	9413 (40.94)	10473 (40.94)
Diabetes		802 (30.97)	6557 (28.52)	7359 (28.77)
Rheumatoid arthritis/ collagen vascular diseases		699 (26.99)	6457 (28.09)	7156 (27.98)
Psychoses		705 (27.22)	5845 (25.42)	6550 (25.61)
Fluid and electrolyte disorders		809 (31.24)	5413 (23.55)	6222 (24.32)
Cardiac arrhythmias		745 (28.76)	5252 (22.84)	5997 (23.44)
Chronic pulmonary disease		658 (25.41)	4702 (20.45)	5360 (20.95)
Congestive heart failure		726 (28.03)	4508 (19.61)	5234 (20.46)
Renal failure		443 (17.1)	3086 (13.42)	3529 (13.80)
Liver disease		84 (3.24)	607 (2.64)	691 (2.7)
Metastatic cancer		69 (2.66)	323 (1.4)	392 (1.53)

Appendix 7: Associations between the most prevalent comorbidities (considered together with clinical, inpatient, and demographic characteristics) and 60-day all-cause mortality in continuing care residents in Alberta who were confirmed tested first positive or first negative with a Covid-19 infection between, March 1, 2020, to March 31, 2021.

Comorbidities					
Num of Elixhauser		1.05 (1.04, 1.07)	< 0.01	1.03 (1.01, 1.05)	< 0.01
Hypertension, uncomplicated	Yes	0.97 (0.9, 1.06)	0.53	0.79 (0.71, 0.88)	< 0.01
Depression	Yes	0.84 (0.78, 0.91)	< 0.01	0.94 (0.86, 1.04)	0.26
Other neurological disorders	Yes	1.00 (0.92, 1.08)	0.99	0.96 (0.88, 1.06)	0.46
Diabetes	Yes	1.12 (1.03, 1.23)	0.01	1.11 (1.00, 1.23)	0.06
Rheumatoid arthritis/ collagen vascular diseases	Yes	0.95 (0.86, 1.4)	0.24	0.82(0.74, 0.92)	< 0.01
Psychoses	Yes	1.1 (1, 1.2)	0.05	1.05 (0.94, 1.17)	0.4
Fluid and electrolyte disorders	Yes	1.47 (1.35, 1.61)	< 0.01	1.19 (1.07, 1.34)	< 0.01
Cardiac arrhythmias	Yes	1.36 (1.25, 1.5)	< 0.01	1.04 (0.93, 1.17)	0.51
Chronic pulmonary disease	Yes	1.32 (1.2, 1.45)	< 0.01	1.14 (1.02, 1.28)	0.16
Congestive heart failure	Yes	1.6 (1.46, 1.75)	< 0.01	1.2 (1.06, 1.35)	< 0.01
Renal failure	Yes	1.33 (1.19, 1.48)	< 0.01	1.09 (0.95, 1.25)	0.2
Liver disease	Yes	1.24 (0.98, 1.56)	0.07	1.51 (1.15, 1.99)	< 0.01
Metastatic cancer	Yes	1.92 (1.48, 2.5)	0.00	1.58 (1.14, 2.19)	< 0.01