Supplementary Material

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METHODS:

Data Sources
ED visits were identified from the Canadian Institutes of Health Information National Ambulatory Care Reporting System (CIHI-NACRS). NACRS is an administrative database that contains anonymized, abstracted data on all ED patient visits in the province of Ontario; it contains over 300 data points on every ED visit. Reporting to NACRS is mandatory in Ontario. Data in NACRS are reviewed and errors and/or missing data are identified, and returned to the submitting hospital as necessary for resubmission; therefore, missing data for mandatory variables in NACRS is very low.

Study Participants
The main discharge diagnosis in NACRS, which uses ICD-10 codes, was used to identify patients with the diagnoses of interest**.** See Table e1 for the ICD-10 codes used to identify each of the fiver emergent diagnoses.

Covariates
Where available, validated algorithms were used to identify patient risk factors and comorbidities in the linked databases. See Table e2 for previously validated algorithms to identify comorbidities with ICES data. Where validated algorithms were not available, the patient was considered to have a past medical history of the disease in question if they had, within the 5 years prior to the ED visit, one diagnosis in the DAD, or two outpatient diagnoses in the OHIP databases, or two main diagnoses in NACRS, or one each from NACRS and the OHIP database. This approach is a similar strategy used in many of the validated algorithms. See Table e3 for codes to identify other comorbidities. To identify patients with a history of cancer, the Ontario Cancer Registry (OCR) was used. The OCR is a registry that contain all the diagnosed cases of cancer (expect squamous and basal cell carcinoma) in the province. To examine rurality, the Rural Index of Ontario (RIO) score was used. The RIO score is a continuous score calculated by Statistics Canada, and is assigned to each patient based on postal code.[5] The score incorporates: population density, distance to basic referral centre, and distance to advanced referral centre. A higher RIO score is indicative of a more rural area, with scores greater than 40 considered to be rural based on funding models by the Ministry of Health and Long Term Care. The John Hopkins Adjusted Clinical Group (ACG) case-mix system is a measure of patient acuity/comorbidity. Diagnoses are assigned to one of 32 diagnostic cluster (Adjusted Diagnostic Groups (ADG); patients with the greatest number of high-risk clusters are generally sickest and require the most health care resources. In an ambulatory cohort, the ADG score is similar in principle to the use of Charlson Comorbidity Index in studies of hospitalized patients. Hospital type was categorized as “academic”, “community”, or “small”, based on government classifications.

Table e1: Description of which databases variables were extracted from

Database	Description	Data
Discharge Abstract Database (DAD)	Acute care hospitalization	- Hospitalizations - In-patient surgery - Comorbidities
National Ambulatory Care Reporting System (NACRS)	Emergency department visits	- ED visits - Comorbidities
Ontario Cancer Registry (OCR)	All diagnosed cases of cancer (except basal and squamous cell carcinoma)	- Cancer
Ontario Health Insurance Plan (OHIP) database	Physician billings for medically necessary care	- Comorbidities
Registered Persons Database	Demographic and mortality data for Ontario residents	- Demographics - Mortality
Same Day Surgery database	Outpatient surgical procedures	- Outpatient surgery

Table e2: ICD-10 codes in the main discharge diagnosis in CIHI-NACRS to identify emergent diagnoses

Diagnosis	ICD-10 Code	Description
Acute appendicitis	K35	Acute appendicitis
	K350	Acute appendicitis with generalized peritonitis
	K351	Acute appendicitis with peritoneal abscess
	K352	Acute appendicitis with generalized peritonitis
	K353	Acute appendicitis with localized peritonitis
	K358	Acute appendicitis, other and unspecified
	K359	Acute appendicitis, unspecified
Ectopic pregnancy	O00	Ectopic Pregnancy
	O000	Abdominal pregnancy
	O001	Tubal pregnancy
	O002	Ovarian pregnancy
	O008	Other ectopic pregnancy
	O009	Ectopic pregnancy, unspecified
Hyperkalemia	E875	Hyperkalaemia
Acute Renal Failure	E102, E112, E132, E142, I12, I13, N01.*, N03.*, N05.*, N08.*, N18.*, N19.*, N25.* with dialysis OHIP: R849, R850, G323, G325, G326, G330, G331, G860, G333, G083, G091, G085, G295, G082, G090, G092, G093, G094, G861, G862, G863, G864, G865, G866, G294, G095, G096 CCP: 51.95, 66.98 CCI: 1PZ21HQBR, 1PZ21HPD4	
DKA	E10.0*	Type 1 diabetes mellitus with coma
	E10.1*	Type 1 diabetes mellitus with ketoacidosis
	E11.0*	Type 2 diabetes mellitus with coma
	E11.1*	Type 2 diabetes mellitus with ketoacidosis
	E13.0*	Other specified diabetes mellitus with coma
	E13.1*	Other specified diabetes mellitus with ketoacidosis
	E14.0*	Unspecified diabetes mellitus with coma
	E14.1*	Unspecified diabetes mellitus with ketoacidosis
Cellulitis	L03*	Cellulitis

Table e3: Validated algorithms for comorbidities

Comorbidity	Sensitivity %	Specificity %	Reference
CAD	88.8	92.8	1
CHF	84.8	97.0	2
COPD	57.5	95.4	3
Diabetes	86.0	97.0	5
Hypertension	73.0	95.0	6

CAD: coronary artery disease; CHF: congestive heart failure; COPD: chronic pulmonary obstructive disease

References:

1) Austin PC, Daly PA, Tu JV. A multicenter study of the coding accuracy of hospital discharge administrative data for patients admitted to cardiac care units in Ontario. *Am Heart J.* 2002;144(2):290-296.
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3) Gershon AS, Wang C, Guan J, Vasilevska-Ristovska J, Cicutto L, To T. Identifying individuals with physician diagnosed COPD in health administrative databases. *COPD.* 2009;6(5):388.
4) Jaakkimainen RL, Bronskill SE, Tierney MC, et al. Identification of Physician-Diagnosed Alzheimer's Disease and Related Dementias in Population-Based Administrative Data: A Validation Study Using Family Physicians' Electronic Medical Records. *J Alzheimers Dis.* 2016;54(1):337-349.
5) Hux JE, Ivis F, Flintoft V, Bica A. Diabetes in Ontario: determination of prevalence and incidence using a validated administrative data algorithm. *Diabetes Care.* 2002;25(3):512.
6) Tu K, Campbell NR, Chen ZL, Cauch-Dudek KJ, McAlister FA. Accuracy of administrative databases in identifying patients with hypertension. *Open Medicine.* 2007;1(1):e18.

Table e4: Codes to identify other comorbidities/covariates

Comorbidity	ICD-10 DX10CODE	OHIP DXCODE
Cancer (last 5 years)	OCR	OCR
Renal Failure	N01.*, N03.*, N05.*, N18.*, N19.*,	585, 584
Liver Failure	K70.4, K72.1, K72.9, K76.6, K76.7,	571
Stroke	I63.*, I64.*, H34.*	436, 437
CAD	I20.*, I21.*, I22.*, I23.*, I24.*, I25.*	410, 412, 413

OCR: Ontario Cancer Registry; ALR: Activity Level Reporting database; NDFP = New Drug Funding Program database

Table e5: Overall and cohort exclusions for each year

	2018	2019	2020	TOTAL
	N=103,764	**N=102,850**	**N=87,314**	**N=293,928**
Overall Exclusions				
Invalid IKN (not in RPDB)	<=5 (0.0%)	<=5 (0.0%)	<=5 (0.0%)	10 (0.0%)
Age < 18	8,832 (8.5%)	9,035 (8.8%)	6,226 (7.1%)	24,093 (8.2%)
Not OHIP eligible on date of ED visit	145 (0.1%)	150 (0.1%)	124 (0.1%)	419 (0.1%)
Left without seen/ against medical advice	706 (0.7%)	775 (0.8%)	642 (0.7%)	2,123 (0.7%)
Not ON resident	54 (0.1%)	64 (0.1%)	75 (0.1%)	193 (0.1%)
Problematic dates	<=10 (0.0%)	<=15 (0.0%)	<=5 (0.0%)	19 (0.0%)
Multiple ED visits (of same diagnoses) within time period	18,610 (17.9%)	17,634 (17.1%)	14,742 (16.9%)	50,986 (17.3%)
Included in cohort	**75,408 (72.7%)**	**75,178 (73.1%)**	**65,499 (75.0%)**	**216,085 (73.5%)**
Appendicitis – Further exclusions	N=7,985	N=8,219	N=7,781	N=23,985
Problematic Dates, death before discharge	7 (0.1%)	6 (0.1%)	10 (0.1%)	23 (0.1%)
Included in analysis	**7,978 (99.9%)**	**8,213 (99.9%)**	**7,771 (99.9%)**	**23,962 (99.9%)**
Ectopic – Further exclusions	N< 2,700	N<2,700	N<2,700	N=7,777
Problematic Dates	<=5 (0.0%)	<=5 (0.0%)	<=5 (0.0%)	<=5 (0.0%)
Included in analysis	**2,618 (100.0%)**	**2,668 (100.0%)**	**2,490 (100.0%)**	**7,776 (100.0%)**
Acute Renal Failure/Hyperkalemia – Further exclusions	N=4,846	N=4,732	N=3,954	N=13,532
Problematic Dates, death before discharge, missing dates	9 (0.2%)	9 (0.2%)	12 (0.2%)	30 (0.2%)
Included in analysis	**4,837 (99.8%)**	**4,723 (99.8%)**	**3,942 (99.7%)**	**13,502 (99.8%)**
Diabetic Ketoacidosis – Further exclusions	N< 3,400	N<3,400	N<3,400	N=9,978
Problematic Dates, death before discharge, missing dates	<=10 (0.1%)	<=10 (0.1%)	<=10 (0.1%)	21 (0.2%)
Included in analysis	**3,261 (99.7%)**	**3,320 (99.8%)**	**3,376 (99.9%)**	**9,957 (99.8%)**
Cellulitis – Further exclusions	N=56,688	N=56,232	N=47,893	N=160,813
Problematic Dates, missing dates	9 (0.0%)	9 (0.0%)	7 (0.0%)	25 (0.0%)
Included in analysis	**56,679 (100.0%)**	**56,223 (100.0%)**	**47,886 (100.0%)**	**160,788 (100.0%)**

*some cells <=5 have been supressed, other cells have been supressed to prevent back calculation.