

Appendix 1 (as supplied by the author):

The Risk of Death Within 5 Years of First Hospitalization in Older Adults

Description of datasets:

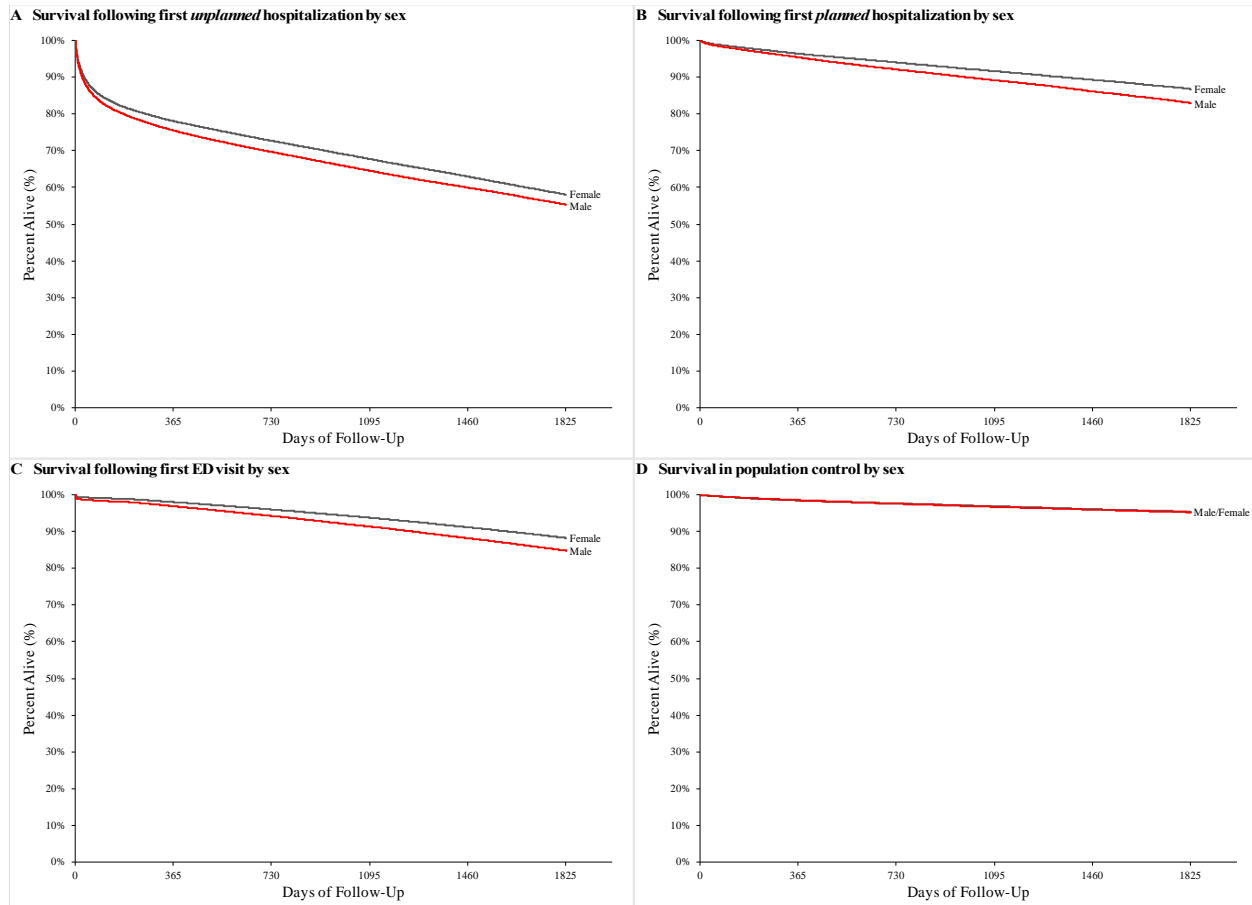
Database	Description
Canadian Institute for Health Information Discharge Abstract Database (CIHI-DAD)	<p>Contains detailed diagnostic and procedural information for all hospital admissions in Canada.</p> <p>DAD records have been demonstrated to have excellent agreement (over 99%) for demographic and administrative data. Regarding diagnoses, median agreement between original DAD records and re-abstracted records for the 50 most common most responsible diagnoses was noted to be 81% (Sensitivity 82%; Specificity 82%). The corresponding median agreement for the 50 most frequently performed surgical procedures was 92% (sensitivity 95%, positive predictive value 91%).(1)</p>
Continuing Care Reporting System Long-Term Care (CCRS-LTC)	<p>Contains demographic, administrative, clinical and resource utilization information on patients who receive continuing care services in hospitals or long-term care (LTC) homes in Canada. The long-term care dataset is generated from the Individual Assessment Instrument Minimum Data Set 2.0, a mandatory comprehensive, standardized and validated instrument for evaluating the needs, strengths, and preferences of elderly adults residing in nursing homes and receiving home care, contains detailed information on the functional status of these people.(2) Full assessments are completed on admission or referral, at quarterly intervals and following any significant health status change.</p>
Home Care Database (HCD)	<p>Contains patient-level data on government-funded home and community services.</p>
National Ambulatory Care Reporting System (NACRS)	<p>Reports demographic, administrative, clinical and service-specific data for Emergency Department visits.</p>
National Rehabilitation Reporting System (NRS)	<p>Contains patient data collected from participating adult inpatient rehabilitation facilities and programs across Canada</p>
Ontario Congestive Heart Failure (CHF)	<p>Contains all Ontario individuals with CHF identified since 1991.</p> <p>A diagnosis of HF was identified by the presence of one hospital record or physician claim, followed by a second record from either source within 1 year. This</p>

	method has been previously validated with a sensitivity of 84.8% and a specificity of 97.0%.(3)
Ontario Drug Benefit (ODB)	Provides individual prescription records including all prescriptions dispensed to Ontario residents aged 65 years and older. Each medication claim has an associated prescriber identifier which indicates the health practitioner who wrote the prescription. An audit of 5,155 randomly selected prescriptions dispensed from 50 Ontario pharmacies determined that the ODB had an error rate of 0.7% and none of the pharmacy characteristics examined (locations, owner affiliation, productivity) were associated with coding errors.(4)
Ontario Health Insurance Plan (OHIP)	Identifies physician billing claims and specialty on all services provided by fee-for-service physicians in Ontario and “shadow billings” for physicians paid under alternate payment plans.
Ontario Mental Health Reporting System (OMHRS)	Documents data on patients in adult designated inpatient mental health beds. This includes beds in General, Provincial Psychiatric, and Specialty Psychiatric facilities.
Registered Persons Database (RPDB)	Registry of all Ontarians eligible to receive insured health services in the province and contains detailed demographic information as well as the Local Health Integration Networks (LHIN), which defines Ontario 14 regional areas within which people received most of their hospital care from local hospitals.
Same Day Surgery (SDS)	Contains patient-level data for day surgery institutions in Ontario. Every record corresponds to one same-day surgery or procedure stay

Identification of comorbidity:

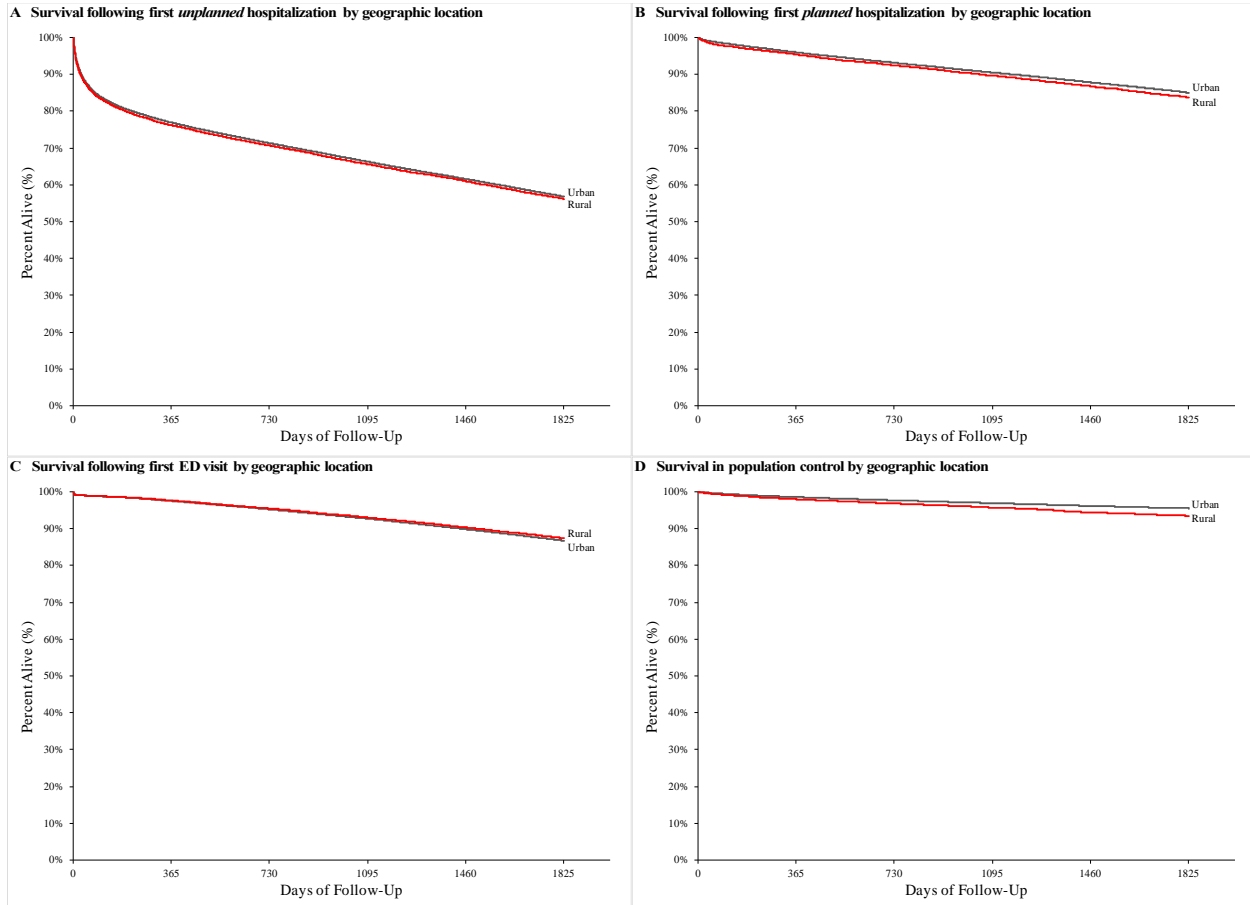
A diagnosis of hypertension was identified by the presence 2 outpatient physician billing claims for hypertension over a 3-year period. This method has been previously validated using chart audits from 1,676 adults in the primary care setting with a sensitivity of 73%, a specificity of 95% and a positive predictive value (PPV) of 87%.(5) A diagnosis of diabetes was identified by the presence of 2 outpatient physician billing claims for diabetes within a 2-year period. This method has been previously validated in a retrospective cohort study of 704,296 adults using chart audits from 3,317 adults in the primary care setting as the reference standard. They reported a sensitivity of 86%, a specificity of 97.0% and a PPV of 80%.(6)

S1 Figure – Survival by sex and study group. Survival stratified by sex following first *unplanned* hospitalization (panel A), *planned* hospitalization (panel B), emergency department visit (panel C) or neither (‘population control’, panel D) in community dwelling adults aged ≥ 66 years in Ontario, Canada between 2007 and 2016.

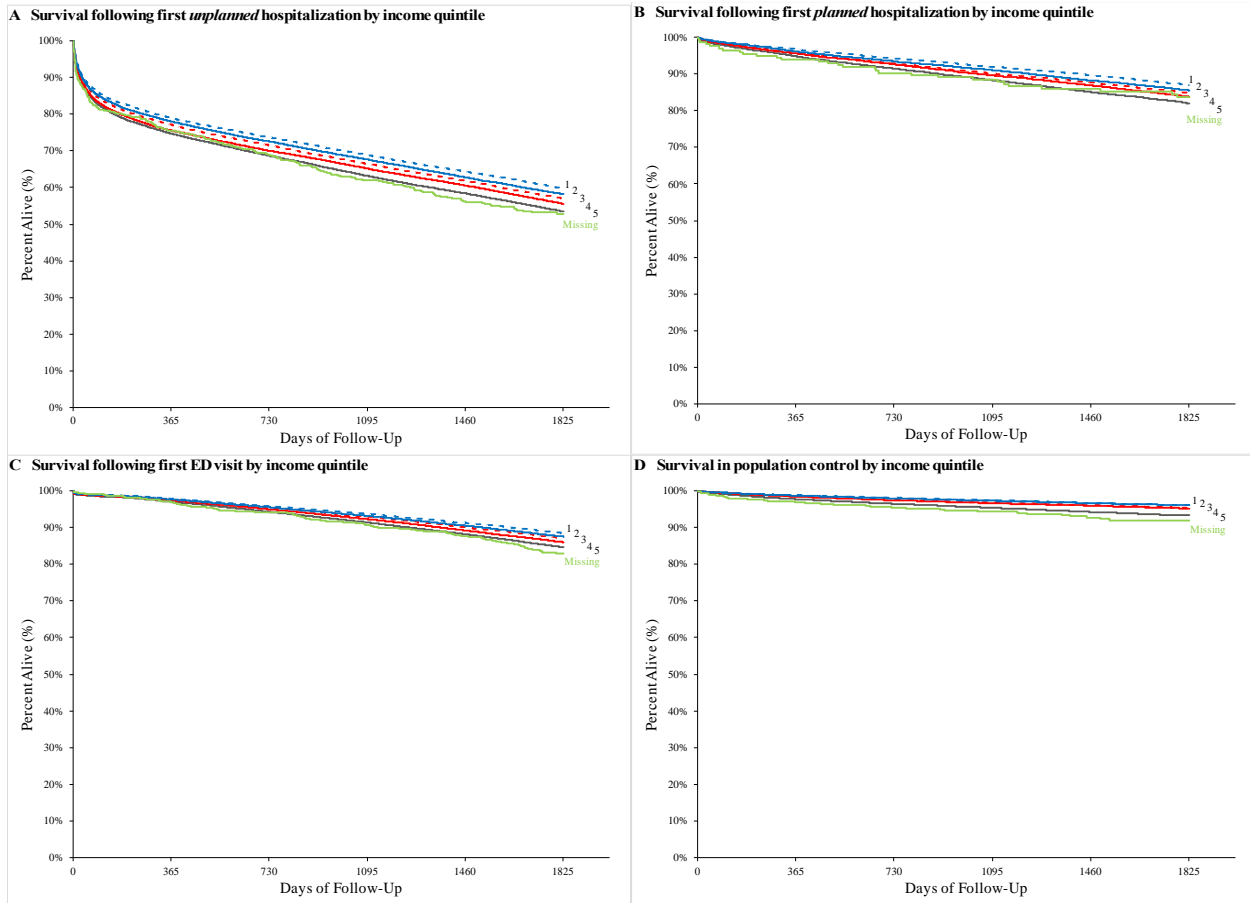


ED – emergency department.

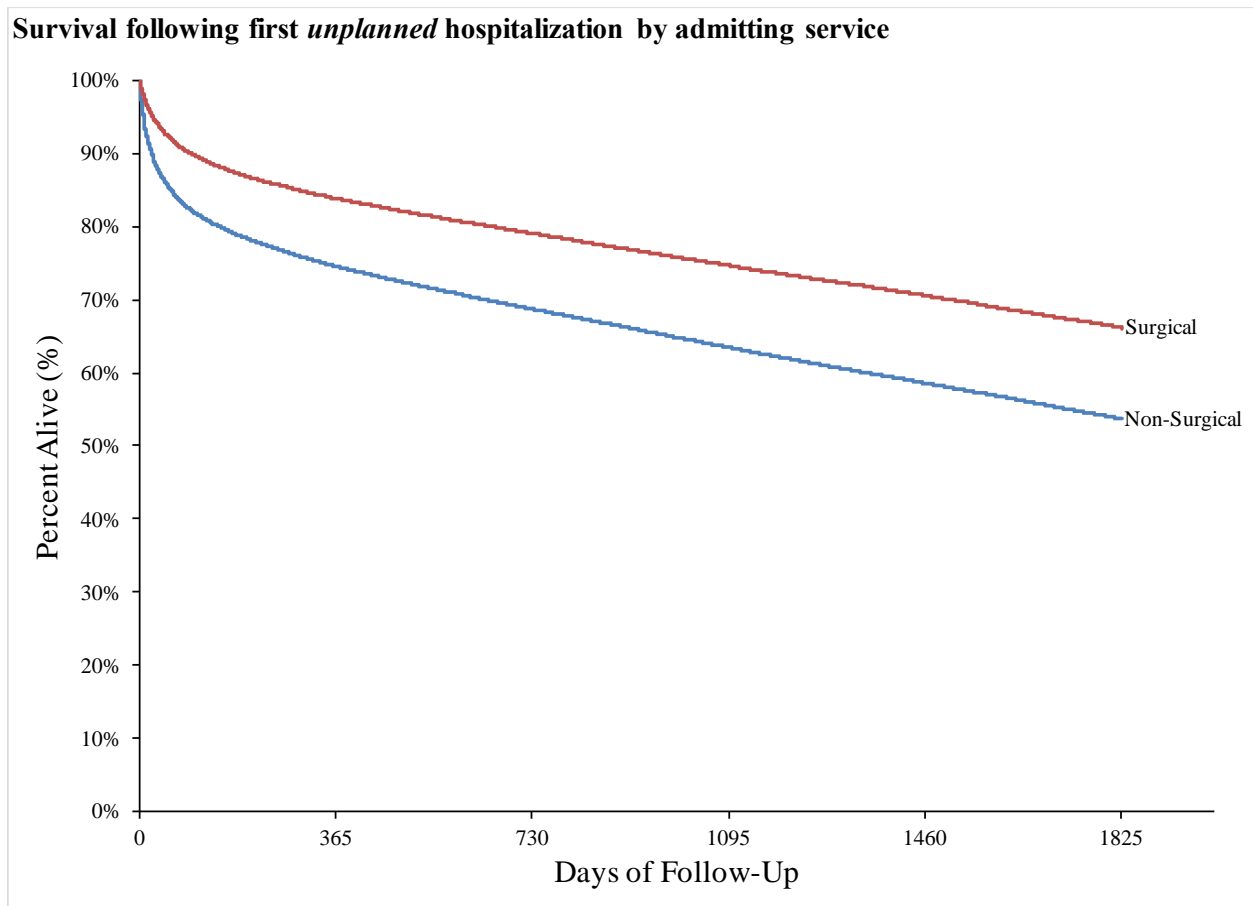
S2 Figure – Survival by geographic location and study group. Survival stratified by geographic location following first *unplanned* hospitalization (panel A), *planned* hospitalization (panel B), emergency department visit (panel C) or neither (‘population control’, panel D) in community dwelling adults aged ≥ 66 years in Ontario, Canada between 2007 and 2016.



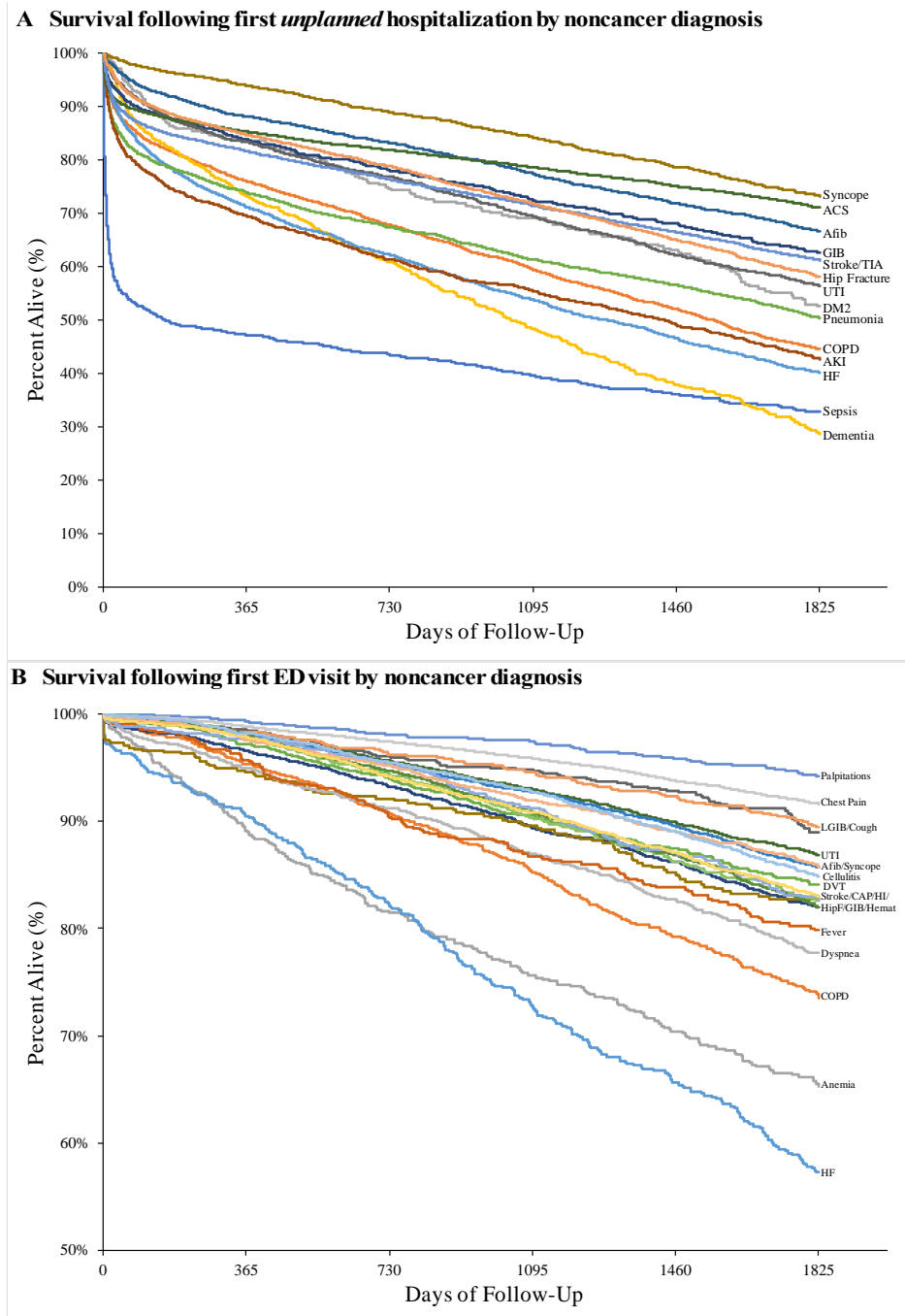
S3 Figure – Survival by income quintile and study group. Survival stratified by income quintile (1 – lowest; 5 – highest) following first *unplanned* hospitalization (panel A), *planned* hospitalization (panel B), emergency department visit (panel C) or neither (‘population control’, panel D) in community dwelling adults aged ≥ 66 years in Ontario, Canada between 2007 and 2016.



S4 Figure – Survival by admitting service. Survival following first *unplanned* hospitalization by admitting service for community-dwelling adults ≥ 66 years of age residing in Ontario, Canada between 2007 and 2016.



S5 Figure – Survival by non-cancer diagnosis. Survival following first *unplanned* hospitalization (panel A) or emergency department visit (panel B) in a subset of common noncancer admission diagnoses in community dwelling adults aged ≥ 66 years in Ontario, Canada between 2007 and 2016. The probability of survival has been truncated in panel B to 0.5.



ACS – acute coronary syndrome; Afib – atrial fibrillation; AKI – acute kidney injury; COPD – chronic obstructive pulmonary disease; CAP – community-acquired pneumonia; DM2 – diabetes mellitus type 2; DVT – deep vein thrombosis; GIB – gastrointestinal bleeding; HF – heart

failure; Hemat – hematuria; HipF – hip fracture; HI – head injury; LGIB – lower gastrointestinal bleeding; TIA – transient ischemic attack; UTI – urinary tract infection.

S1 Table – Admission diagnoses and corresponding cause of death by study group. The 5 most frequent admission diagnoses and corresponding causes of death at 5 years for first hospitalization, ED visit or neither for community-dwelling adults ≥ 66 years residing in Ontario, Canada between 2007 and 2016.

	Exposure Group N=922,074			
	<i>Unplanned hospitalization</i> n = 149,107 (16.2%)	<i>Planned hospitalization</i> n = 82,702 (8.9%)	ED visit n = 327,164 (35.5%)	No hospitalization or ED visit n = 363,101 (39.4%)
Admission Diagnosis, n (%)	Hip Fracture 5,639 (3.8)	Gonarthrosis 8,675 (10.5)	Chest Pain 12,513 (3.8)	--
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Cause of Death	Neoplasm 5,162 (8.7)	Neoplasm 1,007 (9.4)	Neoplasm 2,450 (6.9)	Atherosclerotic Heart Disease 1,610 (14.3)
	Congestive heart failure 4,392 (3.0)	Coxarthrosis 5449 (6.6)	Dizziness and Giddiness 8,253 (2.5)	--
	Atherosclerotic heart disease 2,600 (4.4)	Colon Cancer 518 (4.8)	Atherosclerotic Heart Disease 2,143 (6.0)	Myocardial Infarction 733 (6.5)
	Myocardial Infarction 3,988 (2.7)	Hyperplasia of Prostate 3,976 (4.8)	Urinary tract infection 8,132 (2.5)	--
	Dementia 2,242 (3.8)	Secondary Neoplasm 505 (4.7)	Myocardial Infarction 1,590 (4.5)	Dementia 686 (6.1)
	Pneumonia 3,853 (2.6)	Atherosclerotic Heart Disease 3,962 (4.8)	Syncope 7,347 (2.3)	--
	Myocardial Infarction 2,124 (3.6)	Atherosclerotic Heart Disease 367 (3.4)	Dementia 1,542 (4.3)	Alzheimer's Disease 363 (3.2)
	Stroke 3197 (2.1)	Other Primary Gonarthrosis 3,550 (4.3)	Abdominal Pain 6,661 (2.0)	--
	Pneumonia 1,688 (2.9)	Prostate Cancer	Pneumonia 845 (2.4)	Neoplasm 308 (2.7)

Appendix to: Quinn KL, Stall NM, Yao Z, et al. The risk of death within 5 years of first hospital admission in older adults. CMAJ 2019. doi: 10.1503/cmaj.190770. Copyright © 2019 Joule Inc. or its licensors

		294 (2.7)		
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ED – emergency department, COPD – Chronic obstructive pulmonary disease

S2 Table – Cause of death by study group. Most frequent cause of death at 5 years following first hospitalization, ED visit or neither by diagnostic grouping based on a modified Becker’s leading cause of death for all community-dwelling adults ≥66 years residing in Ontario, Canada between 2007 and 2016.

	Exposure Group N=922,074			
	<i>Unplanned hospitalization</i> n = 149,107 (16.2%)	<i>Planned hospitalization</i> n = 82,702 (8.9%)	ED visit n = 327,164 (35.5%)	No hospitalization or ED visit n = 363,101 (39.4%)
Cause of Death, n (%)	Neoplasms 19678 (13.2)	Neoplasms 5884 (7.1)	Neoplasms 9854 (3.0)	Diseases of the circulatory system 3969 (1.1)
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	Diseases of the circulatory system 14499 (9.7)	Diseases of the circulatory system 1663 (2.0)	Diseases of the circulatory system 9645 (2.9)	Neoplasms 1057 (0.3)
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	Diseases of the respiratory system 5219 (3.5)	Diseases of the respiratory system 468 (0.6)	Diseases of the respiratory system 2537 (0.8)	Diseases of the nervous system 879 (0.2)
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	Mental and behavioural disorders 2743 (1.8)	Diseases of the digestive system 265 (0.3)	Mental and behavioural disorders 1846 (0.6)	Mental and behavioural disorders 864 (0.2)
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	Diseases of the digestive system 2431 (1.6)	External causes of morbidity and mortality 238 (0.3)	Diseases of the nervous system 1480 (0.5)	Diseases of the respiratory system 493 (0.1)
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	External causes of morbidity and mortality 2064 (1.4)	Mental and behavioural disorders 178 (0.2)	External causes of morbidity and mortality 1359 (0.4)	Endocrine, nutritional and metabolic diseases 476 (0.1)
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	Diseases of the nervous system 1788 (1.2)	Endocrine, nutritional and metabolic diseases	Diseases of the digestive system 1110 (0.3)	External causes of morbidity and mortality 308 (0.1)

	----- Endocrine, nutritional and metabolic diseases 1540 (1.0)	175 (0.2) ----- Diseases of the nervous system 165 (0.2)	----- Endocrine, nutritional and metabolic diseases 1063 (0.3)	----- Symptoms, signs and abnormal clinical and laboratory findings not elsewhere classified 224 (0.1)
	----- Diseases of the genitourinary system 1501 (1.0)	----- Certain infectious and parasitic diseases 162 (0.2)	----- Diseases of the genitourinary system 683 (0.2)	----- Diseases of the digestive system 149 (0.0)
	----- Certain infectious and parasitic diseases 1391 (0.9)	----- Diseases of the genitourinary system 155 (0.2)	----- Certain infectious and parasitic diseases 608 (0.2)	----- Diseases of the genitourinary system 57 (0.0)

ED – emergency department, COPD – Chronic obstructive pulmonary disease

S3 Table – Healthcare use by study group. Cumulative healthcare use at 5 years following first hospitalization, ED visit or neither for community-dwelling adults ≥ 66 years residing in Ontario, Canada between 2007 and 2016.

	Exposure Group N=922,074			
	<i>Unplanned hospitalization</i> n = 149,107 (16.2%)	<i>Planned hospitalization</i> n = 82,702 (8.9%)	ED visit n = 327,164 (35.5%)	No hospitalization or ED visit n = 363,101 (39.4%)
ED visits, mean (SD)	1.31 (2.25)	1.19 (2.06)	1.52 (2.40)	0.11 (0.44)
Hospitalizations, mean (SD)	1.08 (1.58)	0.85 (1.30)	0.53 (1.05)	0.05 (0.26)
ICU admissions, mean (SD) ^a	0.15 (0.45)	0.11 (0.37)	0.07 (0.30)	0.01 (0.09)

^aResults are expressed as mean because median and IQR for all groups is zero
ED – emergency department, ICU – intensive care unit

S4 Table – Noncancer admission diagnoses. List of noncancer diagnoses that were among the most common reasons for hospitalization or carried the highest risk of mortality at 5 years in older adults with first *unplanned* hospitalization or emergency department visit in Ontario, Canada between 2007 and 2016.

<i>Unplanned Hospitalization</i> (n=149,107)			
ICD-10 Code	Diagnosis	Percent of deaths	Percent of diagnoses
I200, I210, I211, I213, I214, I2149, I219, I249, I2510	Acute Coronary Syndromes	5.9	8.8
G459, I634, I635, I638, I639, I64	Stroke/TIA	5.2	5.9
I500	Congestive heart failure	4.1	3.0
S72080, S72090, S72100	Hip Fracture	3.8	4.1
J440, J441	COPD	3.7	2.9
J189	Pneumonia, unspecified	3.0	2.6
I480, I4890	Atrial Fibrillation	1.6	2.1
N390	Urinary tract infection, site not specified	1.6	1.6
N179	Acute renal failure, unspecified	1.5	1.2
A419	Sepsis, unspecified	1.2	0.7
F03	Unspecified dementia	1.0	0.6
R55	Syncope and collapse	1.0	1.7
K922	Gastrointestinal haemorrhage, unspecified	0.7	0.9
E1163	Type 2 diabetes mellitus with hypoglycaemia	0.2	0.2
TOTAL		34.2	36.3
<i>Emergency Department Visit without Hospitalization</i> (n=327,164)			
ICD-10 Code	Diagnosis	Percent of deaths	Percent of diagnoses
R073, R074	Chest Pain	3.1	5.1
N390	Urinary tract infection, site not specified	2.5	2.5
R55	Syncope and collapse	2.4	2.2

G459, I64	Stroke/TIA	1.8	1.4
S099	Unspecified injury of head	1.8	1.3
J189	Pneumonia, unspecified	1.7	1.2
L0310, L0311	Cellulitis	1.5	1.4
J441, J449	Chronic obstructive pulmonary disease	1.1	0.6
R060	Dyspnea	1.0	0.6
I480, I4890	Atrial Fibrillation	0.9	0.8
I500	Congestive heart failure	0.9	0.3
D649	Anemia, unspecified	0.7	0.3
I802	Phlebitis and thrombophlebitis of other deep vessels of lower extremities	0.7	0.6
R318	Other and unspecified hematuria	0.4	0.3
R509	Fever, unspecified	0.4	0.3
S42200	Fracture of surgical neck of humerus, closed	0.3	0.3
R05	Cough	0.3	0.4
K922	Gastrointestinal haemorrhage, unspecified	0.3	0.2
R002	Palpitations	0.3	0.6
K625	Haemorrhage of anus and rectum	0.2	0.3
TOTAL		22.3	20.7

References

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3. Schultz SE, Rothwell DM, Chen Z, Tu K. Identifying cases of congestive heart failure from administrative data: a validation study using primary care patient records. *Chronic Dis Inj Can*. 2013 Jun;33(3):160–6.
4. Levy AR, O'Brien BJ, Sellors C, Grootendorst P, Willison D. Coding accuracy of administrative drug claims in the Ontario Drug Benefit database. *Can J Clin Pharmacol*. 2003;10(2):67–71.
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6. 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 Mar;25(3):512–6.