

Supplementary data

Szilcz *et al.* Unplanned hospitalisations in older people: illness trajectories in the last year of life

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eTable 1. Data sources

Register	Register holder	Start	Completeness	Geographical coverage	Content	Externally validated
Total Population Register[48]	Statistics Sweden	1968	The over-coverage has been estimated to 0.1 % for Nordic citizens but substantially higher for individuals born outside the Nordic countries (potentially 4–8 %)	Nationwide	Sex, date of birth, country of birth, municipality of residence, living arrangement, civil status, year of first and last immigration, year of last emigration	Yes
National Cause Of Death Register[49]	National Board of Health and Welfare	Complete since 1952	99% of all deaths are documented with an underlying cause of death	Nationwide	Sex, date of birth, underlying and contributing causes of death (ICD-10), place of death, civil status	Yes
National Patient Register[24]	National Board of Health and Welfare	Inpatient care coverage complete since 1987 Specialised outpatient care since 2001	99% of all somatic and psychiatric hospital discharges are registered. Outpatient diagnoses coverage lower than inpatient data but above 80%	Nationwide	Sex, age, date of admission and discharge, planned/unplanned admission, main diagnosis, secondary diagnoses, injuries, medical or surgical procedures, department of admission, provenance, destination.	The inpatient register part has an overall positive predictive value of diagnosis of 85%-95%
Swedish Prescribed Drug Register[50,51]	National Board of Health and Welfare	July 2005	85% of all sold defined daily doses (DDDs) are covered by the register The remaining 15% are Over-the-counter medications (12% of DDDs), drugs administered in hospitals (3% of DDDs)	Nationwide	Sex, age, date of prescription, date of dispensing, type of dispensing (e.g. multi-dose), total dose, prescribed daily dose (free text), number of DDDs dispensed, ATC code, generic name, costs, characteristics of prescribers	Yes
Swedish Register of Education[28]		1985 (annual updates from 2000), earlier versions have been produced in the 1930 and 1970 census,	Population aged 16-74 years old registered as resident in Sweden at 1 January each year. From 2007, information for the group 75+ is also collected	Nationwide	Highest educational attainment	Yes

eTable 2. Classification of causes of death into illness trajectories

Trajectory	ICD-10 codes
1 – Cancer, leading to a short decline with evident terminal phase	
Neoplasm	C00-C26, C30-C34, C37-C41, C43-C58, C60-C85, C88, C90-C97, D00-D09, D32, D33, D37-D48
2 - Organ failure leading to long-term limitations with intermittent acute episodes	
Diabetes	E10-E14, G590, G632, H360, M142, N083
Other endocrinal diseases	E70-E72, E75-E77, E84-E85
Certain infectious and parasitic diseases	A520-A523, A527, A810, A812, B15-B19, B20-B24
Diseases of the blood	D60, D61, D69, D70, D752, D758, D86
Diseases of the cardiovascular system (incl. cerebrovascular diseases)	I231-I233, I238, I25, I50, I60-I64, I67, I688, I69, G46, I65, I66, I680-I682, I27, I42, I43, I51, I520, I70, I73, I74, I792, I970, I971, I978, I980, I981, I988
Diseases of the respiratory system (incl. abnormalities of breathing)	J40-J44, J47, J60-J62, J66, J701, J80, J841, J951-J953, J96, J980-J984, R060, R062-R065, R068
Diseases of the digestive system (incl. liver diseases)	K70-K77, K44, K50, K51, K55, K56, K85, K86, K871, K90
Diseases of the skin	L305, L40-L42, L44, L93, L945
Diseases of the musculoskeletal system	M360, M361, M05, M06, M13, M15, M21, M30-M35, M40-M43, M45-M51, M53, M54, M638, M80, M81, M820, M821, M843, M844, M86-M88, M907, M961
Diseases of the genitourinary system (incl. renal failure)	N02-N05, N11, N12, N136, N160, N18, N19, N25, N312, N318, N319, N82
Other (incl. congenital conditions)	Q01-Q06, Q078, Q079, Q20-Q28, Q31, Q33, Q40-Q45, Q60-Q68, Q714, Q75-Q79, Q850, Q86-87, Q89-Q93, Q95-Q97, Q99
3 – Prolonged dwindling, characterized by a progressive loss of both physical and cognitive capacities	
Alzheimer's disease	G30-G32
Mental and behavioural disorders	F00, F01, F02, F03, F05, F06, R54
Parkinson's disease	G20-G23
Multiple sclerosis	G35-G37
Other diseases of the nervous system	G10, G12, G70-G73, G03-G05, G07, G478, G518, G551, G608, G80-G83, G90-G99
4 - Sudden death	
None of the three trajectories above	

Abbreviations: ICD-10, International Classification of Diseases 10th revision

eTable 3. Details of diagnosis codes and drugs used to detect chronic conditions

Chronic disease	ICD-10 Codes	ATC Codes
Source(s) of data:	National cause of death register (all contributing causes of death) National patient register (all inpatient and specialized outpatient diagnoses)	Swedish Prescribed Drugs Register
1. Allergy	J30.1-J30.4; J45.0; K52.2; L20; L23; L50.0; Z51.6	
2. Anaemia	D50-D53; D55-D59 (excl. D56.3; D59.0; D59.2; D59.3; D59.6); D60-D64 (excl. D60.1; D61.1; D61.2; D62; D64.2)	B03A, B03XA
3. Asthma	J45	R03DC; R03BC
4. Atrial fibrillation	I48	
5. Autoimmune diseases	I73.1; L10 (excl. L10.5); L12; L40; L41; L93-L95; M30-M36 (excl. M32.0; M34.2; M35.7-M35.9; M36.0; M36.1; M36.2; M36.3)	D05
6. Blindness, visual loss	H54 (excl. H54.3); Z44.2; Z97.0	
7. Blood and blood forming organ diseases	D66-D69 (excl. D68.3; D68.4; D69.5); D71; D72.0; D73.0-D73.2; D74 (excl. D74.8); D75.0; D76.1; D76.3; D77; D80 (excl. D80.7); D81-D84; D86; D89 (excl. D89.1; D89.3)	
8. Bradycardias and conduction diseases	I44.1-I44.3; I45.3; I45.5; Z95.0	
9. Cardiac valve diseases	I05-I08; I09.1; I09.8; I34-I38; I39.0-I39.4; Q22; Q23; Z95.2-Z95.4	
10. Cataract and other lens diseases	H25-H28; Q12; Z96.1	
11. Cerebrovascular disease	G45; G46; I60-I64; I67; I69	
12. Chromosomal abnormalities	Q90-Q99	
13. Chronic infectious diseases	A15-A19; A30; A31; A50-A53 (excl. A51); A65-A67; A69.2; A81; B20-B24; B38.1; B39.1; B40.1; B57.2-B57.5; B65; B92; B94; J65; M86.3-M86.6	J04A, excl. J04AB01, J04AB02, J04AB03 and J04AC
14. Chronic kidney disease	I12.0; I13.0-I13.9; N01, N02, N04, N05; N07; N08; N11; N18.3-N18.9; Q60; Q61.1-Q61.9; Z90.5; Z94.0	
15. Chronic liver disease	B18; K70 (excl. K70.0; K70.1); K71.3-K71.5; K71.7; K72.1; K73; K74; K75.3-K75.8; K76.1; K76.6; K76.7; K77.8; Q44.6; Z94.4	
16. Chronic pancreas, biliary tract and gallbladder diseases	K80.0; K80.1; K80.2; K80.8; K81.1; K86 (excl. K86.2; K86.3; K86.9); Q44.0-Q44.5; Q45.0	A09AA02
17. Chronic ulcer of the skin	I83.0; I83.2; L89; L97; L98.4	

Chronic disease	ICD-10 Codes	ATC Codes
Source(s) of data:	National cause of death register (all contributing causes of death) National patient register (all inpatient and specialized outpatient diagnoses)	Swedish Prescribed Drugs Register
18. Colitis and related diseases	K52.0; K52.8; K55.1; K55.2; K57.2-K57.5; K57.8; K57.9; K58; K59.0; K59.2; K62 (excl. K62.0; K62.1; K62.5; K62.6); K63.4; K64 (excl. K64.5);	
19. COPD, emphysema, chronic bronchitis	J41-J44; J47	R03BB
20. Deafness, hearing loss	H80; H90; H91.1; H91.3; H91.9; Q16; Z45.3; Z46.1; Z96.2; Z97.4	
21. Dementia	F00-F03; F05.1; G30; G31	N06DA, N06DX01
22. Depression and mood diseases	F30-F34; F38; F39; F41.2	
23. Diabetes	E10; E11; E13; E14; E89.1	A10
24. Dorsopathies	M40-M43; M47-M53; Q67.5; Q76.4; Q76.1;	
25. Dyslipidemia	E78	
26. Ear, nose, throat diseases	H60.4; H66.1-H66.3; H70.1; H71; H73.1; H74.1; H81.0; H83.1; H83.2; H95; J30.0; J31-J33; J34.1-J34.3; J35; J37; J38.0; J38.6; K05.1; K05.3; K07; K11.0; K11.7; Q30-Q32; Q35-Q38	
27. Epilepsy	G40 (excl. G40.5)	
28. Esophagus, stomach and duodenum diseases	I85; I86.4; I98.2; I98.3; K21; K22.0; K22.2; K22.4; K22.5; K22.7; K23.0; K23.1; K25.4-K25.7; K26.4-K26.7; K27.4-K27.7; K28.4-K28.7; K29.3-K29.9; K31.1-K31.5; Q39; Q40; Z90.3	A02BX
29. Glaucoma	H40.1-H40.9	S01ED
30. Heart failure	I11.0; I13.0; I13.2; I27; I28.0; I42; I43; I50; I51.5; I51.7; I52.8; Z94.1; Z94.3	
31. Hematological neoplasms	C81-C96	
32. Hypertension	I10-I15	
33. Inflammatory arthropathies	M02.3; M05-M14; M45; M46.0; M46.1; M46.8; M46.9	M01CB
34. Inflammatory bowel disease	K50; K51	A07E
35. Ischemic heart disease	I20-I22; I24; I25; Z95.1; Z95.5	C01DA, C01EB18
36. Migraine and facial pain syndromes	G43; G44.0-G44.3; G44.8; G50	N02C
37. Multiple sclerosis	G35	
38. Neurotic, stress-related and somatoform diseases	F40-F48 (excl. F43.0; F43.2)	
39. Obesity	E66	

Chronic disease	ICD-10 Codes	ATC Codes
Source(s) of data:	National cause of death register (all contributing causes of death) National patient register (all inpatient and specialized outpatient diagnoses)	Swedish Prescribed Drugs Register
40. Osteoarthritis and other degenerative joint diseases	M15-M19; M36.2; M36.3	
41. Osteoporosis	M80-M82	M05BA; M05BB; M05BX03; M05BX53
42. Other cardiovascular diseases	I09 (excl. I09.1; I09.8); I28.1; I31.0; I31.1; I45.6; I49.5; I49.8; I70-I72 (excl. I70.2); I79.0; I79.1; I95.0; I95.1; I95.8; Q20; Q21; Q24-Q28; Z95.8; Z95.9	
43. Other digestive diseases	K66.0; K90.0-K90.2; K91.1; K93; Q41-Q43; R15; Z90.4; Z98.0	
44. Other eye diseases	H02.2-H02.5; H04 (excl. H04.3); H05 (excl. H05.0); H10.4; H17; H18.4-H18.9; H19.3; H19.8; H20.1; H21; H31.0-H31.2; H31.8; H31.9; H33; H35.2-H35.5; H35.7-H35.9; H36; H47-H49 (excl. H47.0; H47.1; H48.1); H51; Q10-Q15 (excl. Q12); Z94.7	
45. Other genitourinary diseases	B90.1; N20.0; N20.2; N20.9; N21.0; N21.8; N21.9; N22; N30.1-N30.4; N31; N32.0; N32.3; N32.8; N32.9; N33; N35; N39.3; N39.4; N48.0; N48.4; N48.9; N70.1; N71.1; N73.1; N73.4; N73.6; N76.1; N76.3; N81; N88; N89.5; N90.5; N95.2; Q54; Q62.0-Q62.4; Q62.7; Q62.8; Q63.8; Q63.9; Q64.0; Q64.1; Q64.3-Q64.9; Z90.6; Z90.7; Z96.0	
46. Other metabolic diseases	E20-E31 (excl. E23.1; E24.2; E24.4; E27.3; E30); E34 (excl. E34.3; E34.4); E35 (excl. E35.0); E40-E46 (excl. E44.1); E64; E70-E72; E74-E77; E79 (excl. E79.0); E80 (excl. E80.4); E83-E89 (excl. E86; E87; E88.3; E89.0; E89.1); K90.3; K90.4; K90.8; K90.9; K91.2; M83; M88; N25	
47. Other musculoskeletal and joint diseases	B90.2; M21.2-M21.9; M22-M24; M25.2; M25.3; M35.7; M61; M65.2-M65.4; M70.0; M72.0; M72.2; M72.4; M75.0; M75.1; M75.3; M75.4; M79.7; M84.1; M89; M91; M93; M94; M96; M99; S38.2; S48; S58; S68; S78; S88; S98; T05; T09.6; T11.6; T13.6; T14.7; T90-T98; Q65; Q66; Q68; Q71-Q74; Q77; Q78; Q79.6; Q79.8; Q87; Z44.0; Z44.1; Z89.1-Z89.9; Z94.6; Z96.6; Z97.1	
48. Other neurological diseases	B90.0; D48.2; G04.1; G09-G14 (excl. G13.0; G13.1); G24-G26 (excl. G25.1; G25.4; G25.6); G32; G37; G51-G53 (excl. G51.0); G70; G71; G72.3-72.9; G73 (excl. G73.2-G73.4); G80-G83 (excl. G83.8); G90; G91; G93.8; G93.9; G95; G99; M47.1; Q00-Q07; Q76.0	

Chronic disease	ICD-10 Codes	ATC Codes
Source(s) of data:	National cause of death register (all contributing causes of death) National patient register (all inpatient and specialized outpatient diagnoses)	Swedish Prescribed Drugs Register
49. Other psychiatric and behavioral diseases	F04; F06; F07; F09; F10.2; F10.6; F10.7; F11.2; F11.6; F11.7; F12.2; F12.6; F12.7; F13.2; F13.6; F13.7; F14.2; F14.6; F14.7; F15.2; F15.6; F15.7; F16.2; F16.6; F16.7; F17.2; F17.6; F17.7; F18.2; F18.6; F18.7; F19.2; F19.6; F19.7; F50; F52; F60-F63; F68; F70-F89; F95; F99	N07BB
50. Other respiratory diseases	B90.9; E66.2; J60-J67; J68.4; J70.1; J70.3; J70.4; J84; J92; J94.1; J95.3; J95.5; J96.1; J98 (excl. J98.1); Q33; Q34; Z90.2; Z94.2; Z94.3; Z96.3	
51. Other skin diseases	L13; L28; L30.1; L43 (excl. L43.2); L50.8; L58.1; L85; Q80; Q81; Q82.1; Q82.2; Q82.9	
52. Parkinson and parkinsonism	G20-G23 (excl. G21.0)	N04BA; N04BX
53. Peripheral neuropathy	B91; G54-G60; G62.8; G62.9; G63 (excl. G63.1); M47.2; M53.1; M54.1	
54. Peripheral vascular disease	I70.2; I73 (excl. I73.1; I73.8); I79.2; I79.8	B01AC23
55. Prostate diseases	N40; N41.1; N41.8	G04C (excl. G04CB)
56. Schizophrenia and delusional diseases	F20; F22; F24; F25; F28	
57. Sleep disorders	G47; F51.0-F51.3	
58. Solid neoplasms	All C (excl. C81-C96); D00-D09; D32.0; D32.1; D32.9; D33.0-D33.4; Q85	
59. Thyroid disease	E00-E03 (excl. E03.5); E05; E06.2; E06.3; E06.5; E07; E35.0; E89.0	H03AA; H03B
60. Venous and lymphatic diseases	I78.0; I83; I87; I89; I97.2; Q82.0	

Abbreviations: ICD-10: International Classification of Diseases, 10th revision; ATC: Anatomical Therapeutic Chemical classification system

Table 4. Diagnosis codes and weights used to calculate the Hospital Frailty Risk score[27]

Conditions	ICD10-codes	Weight
Dementia in Alzheimer's disease	F00	7.1
Hemiplegia	G81	4.4
Alzheimer's disease	G30	4
Sequelae of cerebrovascular disease (secondary codes)	I69	3.7
Other symptoms and signs involving the nervous and musculoskeletal systems (R29·6 Tendency to fall)	R29	3.6
Other disorders of urinary system (includes urinary tract infection and urinary incontinence)	N39	3.2
Delirium, not induced by alcohol and other psychoactive substances	F05	3.2
Unspecified fall	W19	3.2
Superficial injury of head	S00	3.2
Unspecified haematuria	R31	3
Other bacterial agents as the cause of diseases classified to other chapters (secondary code)	B96	2.9
Other symptoms and signs involving cognitive functions and awareness	R41	2.7
Abnormalities of gait and mobility	R26	2.6
Other cerebrovascular diseases	I67	2.6
Convulsions, not elsewhere classified	R56	2.6
Somnolence, stupor and coma	R40	2.5
Complications of genitourinary prosthetic devices, implants and grafts	T83	2.4
Intracranial injury	S06	2.4
Fracture of shoulder and upper arm	S42	2.3
Other disorders of fluid, electrolyte and acid-base balance	E87	2.3
Other joint disorders, not elsewhere classified	M25	2.3
Volume depletion	E86	2.3
Senility	R54	2.2
Care involving use of rehabilitation procedures	Z50	2.1
Unspecified dementia	F03	2.1
Other fall on same level	W18	2.1
Problems related to medical facilities and other health care	Z75	2
Vascular dementia	F01	2
Superficial injury of lower leg	S80	2
Cellulitis	L03	2
Blindness and low vision	H54	1.9
Deficiency of other B group vitamins	E53	1.9
Problems related to social environment	Z60	1.8
Parkinson's disease	G20	1.8
Syncope and collapse	R55	1.8
Fracture of rib(s), sternum and thoracic spine	S22	1.8
Other functional intestinal disorders	K59	1.8
Acute renal failure	N17	1.8
Decubitus ulcer	L89	1.7
Carrier of infectious disease	Z22	1.7
Streptococcus and staphylococcus as the cause of diseases classified to other chapters	B95	1.7
Ulcer of lower limb, not elsewhere classified	L97	1.6

Other symptoms and signs involving general sensations and perceptions	R44	1.6
Duodenal ulcer	K26	1.6
Hypotension	I95	1.6
Unspecified renal failure	N19	1.6
Other septicaemia	A41	1.6
Personal history of other diseases and conditions	Z87	1.5
Respiratory failure, not elsewhere classified	J96	1.5
Exposure to unspecified factor	X59	1.5
Other arthrosis	M19	1.5
Epilepsy	G40	1.5
Osteoporosis without pathological fracture	M81	1.4
Fracture of femur	S72	1.4
Fracture of lumbar spine and pelvis	S32	1.4
Other disorders of pancreatic internal secretion	E16	1.4
Abnormal results of function studies	R94	1.4
Chronic renal failure	N18	1.4
Retention of urine	R33	1.3
Unknown and unspecified causes of morbidity	R69	1.3
Other disorders of kidney and ureter, not elsewhere classified	N28	1.3
Unspecified urinary incontinence	R32	1.2
Other degenerative diseases of nervous system, not elsewhere classified	G31	1.2
Nosocomial condition	Y95	1.2
Other and unspecified injuries of head	S09	1.2
Symptoms and signs involving emotional state	R45	1.2
Transient cerebral ischaemic attacks and related syndromes	G45	1.2
Problems related to care-provider dependency	Z74	1.1
Other soft tissue disorders, not elsewhere classified	M79	1.1
Fall involving bed	W06	1.1
Open wound of head	S01	1.1
Other bacterial intestinal infections	A04	1.1
Diarrhoea and gastroenteritis of presumed infectious origin	A09	1.1
Pneumonia, organism unspecified	J18	1.1
Pneumonitis due to solids and liquids	J69	1
Speech disturbances, not elsewhere classified	R47	1
Vitamin D deficiency	E55	1
Artificial opening status	Z93	1
Gangrene, not elsewhere classified	R02	1
Symptoms and signs concerning food and fluid intake	R63	0.9
Other hearing loss	H91	0.9
Fall on and from stairs and steps	W10	0.9
Fall on same level from slipping, tripping and stumbling	W01	0.9
Thyrotoxicosis [hyperthyroidism]	E05	0.9
Scoliosis	M41	0.9
Dysphagia	R13	0.8
Dependence on enabling machines and devices	Z99	0.8
Agent resistant to penicillin and related antibiotics	U80	0.8
Osteoporosis with pathological fracture	M80	0.8
Other diseases of digestive system	K92	0.8
Cerebral Infarction	I63	0.8
Calculus of kidney and ureter	N20	0.7
Mental and behavioural disorders due to use of alcohol	F10	0.7
Other medical procedures as the cause of abnormal reaction	Y84	0.7

Abnormalities of heart beat	R00	0.7
Unspecified acute lower respiratory infection	J22	0.7
Problems related to life-management difficulty	Z73	0.6
Other abnormal findings of blood chemistry	R79	0.6
Personal history of risk-factors, not elsewhere classified	Z91	0.5
Open wound of forearm	S51	0.5
Depressive episode	F32	0.5
Spinal stenosis (secondary code only)	M48	0.5
Disorders of mineral metabolism	E83	0.4
Polyarthrosis	M15	0.4
Other anaemias	D64	0.4
Other local infections of skin and subcutaneous tissue	L08	0.4
Nausea and vomiting	R11	0.3
Other noninfective gastroenteritis and colitis	K52	0.3
Fever of unknown origin	R50	0.1

Abbreviations: ICD-10: International Classification of Diseases, 10th revision;

eTable 5. Categorization of levels of education

Category	ISCED 97	No. decedents
Primary education	Primary level of education (1)	34 983
	Unspecified	30
Secondary education	Lower secondary education (2A)	5 194
	Upper secondary education ≤2 years (3C)	18 935
	Upper secondary education 3 years (3A)	6 413
	Post-secondary non tertiary education (4)	803
	Unspecified	98
Tertiary education	Post-secondary education <3 years (5B)	3 498
	Post-secondary education ≥3 years (5A)	5 335
	Post-graduate education (6)	384
	Unspecified	32
Missing		1 610

Abbreviations: ISCED 97: International Standard Classification of Education 1997

eTable 6. Details of diagnosis codes used to identify potentially unexpected causes of death in older adults

ICD Chapter	Multiple cause of death	Inpatient and specialized care admissions
<i>Source(s) of data:</i>	<i>National cause of death register (underlying and contributing causes of death)</i>	<i>National patient register (all inpatient and specialized outpatient care diagnoses^a)</i>
Certain infectious and parasitic diseases	A00; A01; A02; A03; A04; A05; A06; A07; A08; A09; A39; A40; A41; A499; A80; A81; A87; B371; B375; B377; B440; B441; B448; B449; B99	
Diseases of the blood and blood-forming organs	D611; D619; D649	
Endocrine, nutritional and metabolic diseases	E86	
Diseases of the nervous system	G000; G001; G002; G003; G009; G039; G040; G048; G049; G060; G062; G931; G936	
Ischaemic heart diseases and pulmonary heart diseases	I21; I23; I25; I249; I249; I255; I26; I28	No history of ischemic heart disease (I20-I25) or pulmonary embolism (I26)
Other forms of heart disease	I30; I33; I40; I461; I469	
Cerebrovascular diseases	I60; I61; I62; I63; I64; I65; I66; I67	No history of cerebrovascular disease (I60-I69)
Diseases of arteries, arterioles and capillaries	I71; I72; I74; I97	
Diseases of the respiratory system	J069; J09; J10; J11; J12; J13; J14; J15; J18; J22; J690; J81; J851; J852; J93; J958; J960	
Diseases of the digestive system	K250; K251; K252; K253; K254; K255; K256; K257; K259; K260; K261; K263; K264; K265; K266; K269; K550; K65; K720; K810; K859	
Diseases of the musculoskeletal system and connective tissue	M726	
Diseases of the genitourinary system	N00; N04; N10; N17; N390; N990; N998	No history of diabetes (E10-14) or renal failure (N18-19)
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	R02; R572; R570; R571	
Injury, poisoning and certain other consequences of external causes	S065; S066; S068; S069; S071; S10-99; T00-T99	
External causes of morbidity and mortality	V00-V99; X60-79; X80-84	

Abbreviations: ICD-10: International Classification of Diseases, 10th revision;

a: Diagnoses codes were captured in the National Patient Register during the period ranging from 5 year before death until death.

eTable 7. RECORD Checklist

Item No		Recommendation	Section
Title and abstract	1	(1)The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included.	Abstract
		(2) If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract.	Abstract
		(3) If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	Abstract
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Introduction
Objectives	3	State specific objectives, including any prespecified hypotheses	Introduction - last paragraph
Methods			
Study design	4	Present key elements of study design early in the paper	Methods – Study design and population section, Supplementary eFigure 1
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Methods – Study design and population section
Participants	6	(1) The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided.	Methods – Study design and population section
		(2) Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed methods and results should be provided.	NA
		(3) If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage.	Supplementary eFigure 4
Variables	7	A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided.	Methods – Outcome/Illness trajectories and individual characteristics/Covariates Supplementary eTable 2-6
Data sources/measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Methods – Outcome/Illness trajectories and individual characteristics/Covariates Supplementary eTable 2-6
Bias	9	Describe any efforts to address potential sources of bias	Methods - Outcome
Study size	10	Explain how the study size was arrived at	Supplementary eFigure 4

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Methods – Outcome/Illness trajectories and individual characteristics/Covariates
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	Methods – Statistical analysis
		(b) Describe any methods used to examine subgroups and interactions	NA
		(c) Explain how missing data were addressed	Table 2, Figure 2
		(d) If applicable, explain how loss to follow-up was addressed	NA
		(e) Describe any sensitivity analyses	Methods – Statistical analysis
Data access and cleaning methods		Authors should describe the extent to which the investigators had access to the database population used to create the study population.	Methods – Study design and population
		Authors should provide information on the data cleaning methods used in the study.	NA
		State whether the study included person-level, institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of linkage quality evaluation should be provided.	Methods – Data sources
Results			
Participants	13*	(a) Describe in detail the selection of the persons included in the study (i.e., study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	Supplementary eFigure 4
		(b) Give reasons for non-participation at each stage	Supplementary eFigure 4
		(c) Consider use of a flow diagram	Supplementary eFigure 4
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Table 1
		(c) Summarise follow-up time (eg, average and total amount)	Table 2
Outcome data	15*	Report numbers of outcome events or summary measures over time	
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 2, Methods – Statistical analysis
		(b) Report category boundaries when continuous variables were categorized	NA
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA

Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Results – Sensitivity analysis
Discussion			
Key results	18	Summarise key results with reference to study objectives	Discussion – first paragraph
Limitations	19	Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study being reported.	Discussion – last paragraph
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Discussion first and second paragraphs
Generalisability	21	Discuss the generalisability (external validity) of the study results	Discussion – last paragraph
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Acknowledgements: Funding
Accessibility of protocol, raw data, and programming code		Authors should provide information on how to access any supplemental information such as the study protocol, raw data, or programming code.	Acknowledgements: Availability of data and materials

eTable 8. Fifteen most common main underlying cause of deaths of the decedents of sudden death illness trajectory (N=5700)

Main underlying cause of death (ICD-10)	ICD-10 Description	Frequency (N)	Share (%) of total
I21	Acute myocardial infarction	862	15.12
J18	Pneumonia, unspecified	719	12.61
I71	Aortic aneurysm and dissection	331	5.81
A41	Other sepsis	288	5.05
X59	Exposure to unspecified factor	229	4.02
W19	Unspecified fall	221	3.88
I46	Cardiac arrest	214	3.75
I10	Essential (primary) hypertension	144	2.53
R68	Other general symptoms and signs	138	2.42
I26	Pulmonary embolism	116	2.04
N39	Urinary tract infection, site not specified	111	1.95
K92	Other diseases of digestive system	96	1.68
R64	Cachexia	93	1.63
X70	Intentional self-harm by hanging, strangulation and suffocation	89	1.56
I48	Atrial fibrillation and flutter	82	1.44

Abbreviations: ICD-10: International Classification of Diseases, 10th revision

eTable 9. Incidence rate of unplanned hospitalisation by week, stratified by illness trajectory, sex- and age-standardised (direct standardization)

Weeks before death	Overall	Cancer	Organ failure	Prolonged dwindling	Sudden death
52	1.5	1.6	1.8	1.1	1.0
51	1.5	1.7	1.7	1.2	0.8
50	1.6	1.8	1.8	1.1	1.1
49	1.5	1.6	1.8	1.1	1.3
48	1.6	1.6	2.0	1.1	0.9
47	1.5	1.7	1.8	0.9	0.9
46	1.6	1.8	1.8	1.0	1.3
45	1.6	1.8	2.0	1.1	1.0
44	1.6	1.9	1.9	1.1	1.1
43	1.5	1.8	1.7	1.1	0.9
42	1.7	2.0	2.0	1.1	0.9
41	1.7	2.0	2.0	1.2	1.1
40	1.8	2.2	1.9	1.1	1.5
39	1.8	2.2	2.0	1.1	1.2
38	1.7	2.1	1.8	1.2	1.2
37	1.8	2.1	2.0	1.2	1.3
36	1.9	2.3	2.1	1.2	1.2
35	1.8	2.2	2.1	1.1	1.2
34	1.8	2.4	2.1	1.1	1.0
33	1.9	2.5	2.0	1.3	1.1
32	1.9	2.3	2.3	1.3	1.1
31	1.9	2.6	1.9	1.2	1.1
30	2.0	2.4	2.3	1.4	1.2
29	2.0	2.6	2.1	1.2	1.3
28	2.0	2.7	2.2	1.1	1.2
27	2.1	2.7	2.3	1.3	1.3
26	2.1	2.8	2.3	1.2	1.2
25	2.2	2.8	2.4	1.3	1.2
24	2.3	3.2	2.4	1.3	1.6
23	2.3	3.2	2.6	1.3	1.3
22	2.3	3.1	2.5	1.4	1.7
21	2.5	3.6	2.7	1.5	1.3
20	2.5	3.4	2.8	1.4	1.5
19	2.8	3.7	3.1	1.6	1.7
18	2.8	3.9	3.1	1.6	1.6
17	2.9	3.9	3.2	1.6	1.7
16	3.1	4.6	3.2	1.6	1.7
15	3.2	4.7	3.3	1.8	1.8
14	3.4	5.2	3.6	1.7	1.8
13	3.6	5.5	3.7	1.7	2.2
12	3.9	6.1	3.8	2.0	2.3
11	4.1	6.5	4.1	2.1	2.1
10	4.5	7.1	4.4	2.3	2.4
9	4.8	7.5	4.8	2.4	2.8
8	5.2	8.2	5.2	2.7	2.8
7	5.9	9.3	6.0	3.0	3.1

Weeks before death	Overall	Cancer	Organ failure	Prolonged dwindling	Sudden death
6	6.7	10.8	6.6	3.4	3.3
5	7.9	12.9	7.7	4.2	4.5
4	9.2	14.4	9.2	4.9	5.6
3	11.3	16.9	12.2	5.7	8.4
2	15.3	20.2	18.7	7.6	12.9
1	26.2	24.2	38.0	11.0	43.9

eTable 10. Proportion of decedents with ≥ 1 unplanned hospitalisation during each of the 52 weeks before death, stratified by illness trajectory

Weeks before death	Illness trajectory				
	Overall (%) N= 77 315	Cancer (%) N= 23 213	Organ failure (%) N= 28 338	Prolonged dwindling (%) N= 20 064	Sudden death (%) N= 5 700
52	1.47	1.56	1.78	1.08	0.98
51	1.42	1.61	1.58	1.16	0.82
50	1.50	1.71	1.75	1.03	1.07
49	1.46	1.51	1.71	1.10	1.26
48	1.51	1.56	1.88	1.11	0.91
47	1.44	1.68	1.75	0.90	0.86
46	1.51	1.75	1.76	0.93	1.28
45	1.55	1.75	1.90	0.99	1.00
44	1.57	1.84	1.82	1.06	1.05
43	1.48	1.73	1.67	1.08	0.91
42	1.63	1.93	1.93	1.08	0.86
41	1.64	1.95	1.87	1.13	1.05
40	1.69	2.13	1.84	1.04	1.37
39	1.72	2.09	1.98	1.10	1.16
38	1.64	2.04	1.75	1.16	1.12
37	1.70	2.03	1.91	1.13	1.28
36	1.80	2.22	2.07	1.13	1.11
35	1.72	2.09	2.01	1.06	1.14
34	1.76	2.26	2.00	1.04	1.02
33	1.81	2.33	1.93	1.26	1.00
32	1.85	2.20	2.20	1.18	1.02
31	1.81	2.47	1.87	1.20	1.05
30	1.92	2.30	2.18	1.34	1.14
29	1.90	2.52	2.00	1.18	1.35
28	1.91	2.58	2.14	1.01	1.12
27	1.98	2.57	2.16	1.26	1.28
26	2.01	2.71	2.20	1.18	1.16
25	2.07	2.75	2.30	1.21	1.18
24	2.20	3.02	2.33	1.25	1.60
23	2.23	3.04	2.48	1.22	1.19
22	2.21	2.96	2.37	1.31	1.54
21	2.42	3.38	2.54	1.45	1.32
20	2.40	3.25	2.66	1.31	1.46
19	2.61	3.46	2.87	1.53	1.63
18	2.67	3.67	2.89	1.53	1.58
17	2.72	3.64	3.01	1.57	1.63
16	2.90	4.25	3.02	1.50	1.70
15	3.04	4.39	3.17	1.70	1.67
14	3.21	4.78	3.31	1.68	1.75
13	3.34	5.02	3.40	1.66	2.09
12	3.62	5.47	3.60	1.94	2.16
11	3.80	5.81	3.81	1.98	1.98
10	4.12	6.29	4.09	2.17	2.28

Weeks before death	Illness trajectory				
	Overall (%) N= 77 315	Cancer (%) N= 23 213	Organ failure (%) N= 28 338	Prolonged dwindling (%) N= 20 064	Sudden death (%) N= 5 700
9	4.37	6.55	4.36	2.34	2.67
8	4.72	7.02	4.76	2.62	2.54
7	5.29	7.91	5.29	2.90	2.96
6	5.89	8.92	5.91	3.15	3.04
5	6.87	10.25	6.70	3.93	4.30
4	7.68	10.93	7.77	4.53	5.02
3	9.19	12.16	9.97	5.19	7.30
2	11.74	13.32	14.22	6.76	10.53
1	17.96	14.22	24.48	9.40	30.95

eTable 11. Frequency of trajectories distribution after removing decedents with potentially unexpected cause of death compared to the study population

	Overall	Decedents with potentially unexpected cause of death excluded	
		N	%
Overall	77 315	42 760	55.3
Trajectories			
Cancer	23 213	17 305	74.6
Organ failure	28 338	12 844	45.3
Prolonged dwindling	20 064	11 437	57.0
Sudden death	5 700	1 174	20.6

eTable 12. Incidence rate of unplanned hospitalisation during the last year of life by illness trajectory and rate ratios compared to the overall population, decedents with potentially unexpected cause of death are removed

	No. decedents	Unplanned hospitalisation		Number of person-years	Incidence rate per 100 person-years	Incidence rate ratio ^a	
		No. events	Mean			Unadjusted	Adjusted ^b
Overall^c	42 760	73 108	1.71	40 413	180.9	1.0 (Ref)	1.0 (Ref)
Trajectories							
Cancer	17 305	36 898	2.13	15 961	231.2	1.18 (1.16-1.2)	1.13 (1.12-1.15)
Organ failure	12 844	25 518	1.99	12 119	210.6	1.12 (1.1-1.15)	1.09 (1.06-1.11)
Prolonged dwindling	11 437	9 312	0.81	11 196	83.2	0.46 (0.45-0.48)	0.57 (0.56-0.59)
Sudden death	1 174	1 380	1.18	1 136	121.4	0.65 (0.61-0.7)	0.73 (0.69-0.78)

a: Robust standard errors were used to estimate the confidence intervals; incidence rate ratio obtained from zero-inflated Poisson models

b: Adjusted for sex, age, education, marital status, frailty, number of chronic diseases, polypharmacy; Decedents with missing education variable information (1.95 % of total number of decedents without unexpected cause of death) were excluded from the adjusted analysis.

c: The total study population was used as the reference category to compare the risks across illness trajectories to the average risk in the cohort.

eTable 13. Crude Incidence rate of unplanned hospitalisation by week, stratified by illness trajectories in the last year of life, decedents with potentially unexpected cause of death are removed

Weeks before death	Incidence Rate per 100 Patient weeks				
	Overall	Cancer	Organ failure	Prolonged dwindling	Sudden death
52	1.5	1.6	2.0	1.1	1.0
51	1.5	1.7	1.8	1.1	0.7
50	1.6	1.7	1.9	1.0	1.0
49	1.5	1.5	2.0	1.0	1.4
48	1.6	1.7	2.2	1.0	0.8
47	1.5	1.7	1.9	0.9	0.8
46	1.6	1.7	2.0	0.9	1.3
45	1.7	1.8	2.1	0.9	1.0
44	1.7	1.9	2.0	1.0	0.8
43	1.6	1.8	1.9	1.0	1.2
42	1.8	2.0	2.4	1.0	0.8
41	1.8	2.1	2.1	1.0	1.0
40	1.9	2.2	2.2	1.0	1.4
39	1.9	2.2	2.2	1.1	1.6
38	1.9	2.2	2.1	1.2	1.1
37	1.8	2.2	2.1	1.0	1.1
36	2.0	2.3	2.4	1.1	1.3
35	1.9	2.2	2.2	1.0	1.6
34	2.0	2.4	2.4	1.0	0.9
33	2.0	2.5	2.3	1.1	1.1
32	2.0	2.3	2.6	1.1	1.7
31	2.1	2.6	2.3	1.2	1.6
30	2.1	2.5	2.5	1.3	1.4
29	2.1	2.8	2.3	1.0	1.4
28	2.1	2.7	2.5	1.0	1.1
27	2.2	2.7	2.6	1.1	1.1
26	2.3	2.9	2.6	1.1	1.0
25	2.4	3.0	2.7	1.2	1.2
24	2.5	3.3	2.7	1.2	1.9
23	2.5	3.1	3.0	1.1	1.2
22	2.5	3.3	2.9	1.2	1.7
21	2.7	3.6	3.0	1.3	1.3
20	2.7	3.5	3.0	1.2	1.6
19	3.0	3.8	3.5	1.5	2.1
18	3.1	4.1	3.4	1.4	1.8
17	3.2	4.0	3.7	1.5	2.3
16	3.5	4.8	3.8	1.5	1.5
15	3.6	4.8	3.9	1.6	1.6
14	3.8	5.4	4.0	1.5	2.2

Weeks before death	Incidence Rate per 100 Patient weeks				
	Overall	Cancer	Organ failure	Prolonged dwindling	Sudden death
13	4.0	5.7	4.2	1.6	2.0
12	4.3	6.4	4.2	1.9	1.8
11	4.7	6.9	4.8	1.8	2.5
10	5.1	7.5	5.0	2.0	2.3
9	5.3	7.8	5.2	2.2	3.2
8	5.9	8.7	5.9	2.4	2.5
7	6.5	9.7	6.4	2.7	2.7
6	7.6	11.4	7.8	3.0	2.8
5	8.6	13.4	8.2	3.3	4.3
4	9.6	14.8	9.4	3.8	5.4
3	11.0	16.7	11.9	4.1	7.9
2	13.6	18.5	18.1	4.6	9.5
1	19.1	18.8	35.0	5.5	29.8

eTable 14. Zero-inflated Poisson versus Poisson models' incidence rate ratios of unplanned hospitalisation by illness trajectory compared to the overall population

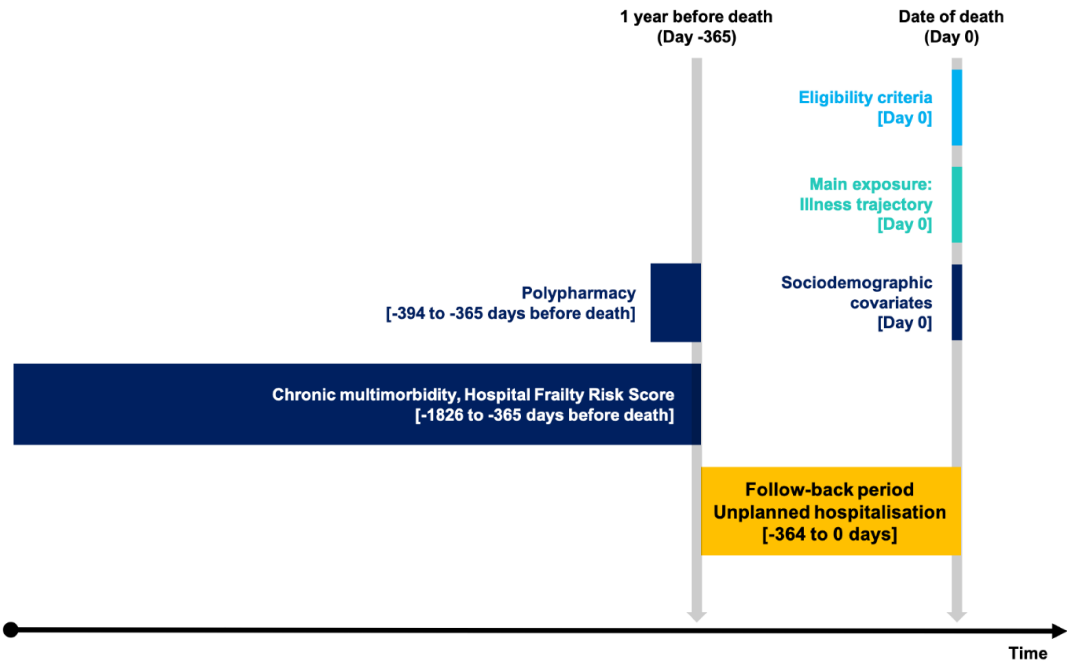
	Adjusted incidence rate ratio ^a	
	ZIP model ^b	Poisson model
Overall^c	1.0 (Ref)	1.0 (Ref)
Trajectories		
Cancer	1.2 (1.18-1.21)	1.24 (1.23-1.26)
Organ failure	1.04 (1.03-1.06)	1.05 (1.03-1.06)
Prolonged dwindling	0.66 (0.65-0.68)	0.65 (0.64-0.67)
Sudden death	0.79 (0.77-0.82)	0.8 (0.77-0.82)
Akaike information criterion	539 677	546 423

a: Adjusted for sex, age, education, marital status, frailty, number of chronic diseases, polypharmacy; Decedents with missing education variable information (2.1% of total) were excluded from the analysis; Robust standard errors were used to estimate the confidence intervals

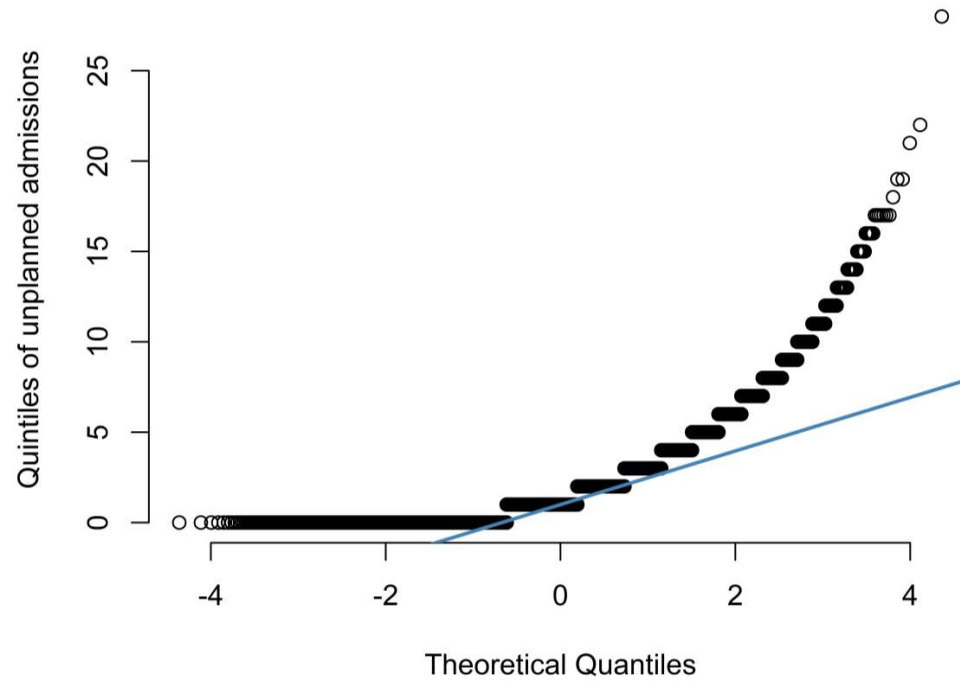
b: Zero-inflated Poisson regression

c: The total study population was used as the reference category to compare the risks across illness trajectories to the average risk in the cohort.

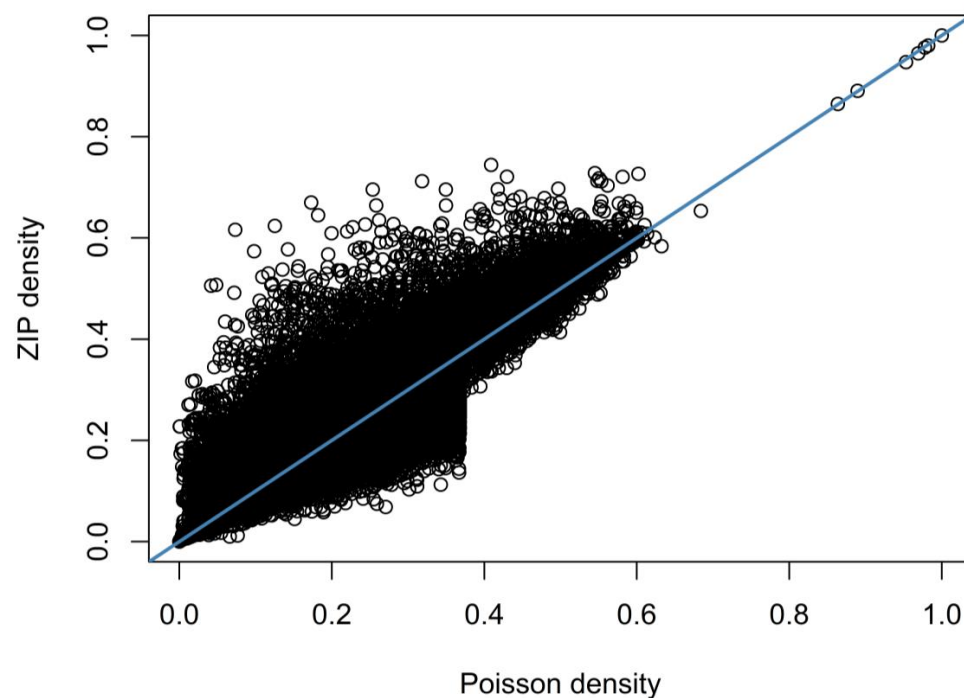
eFigure 1. Illustration of the study design

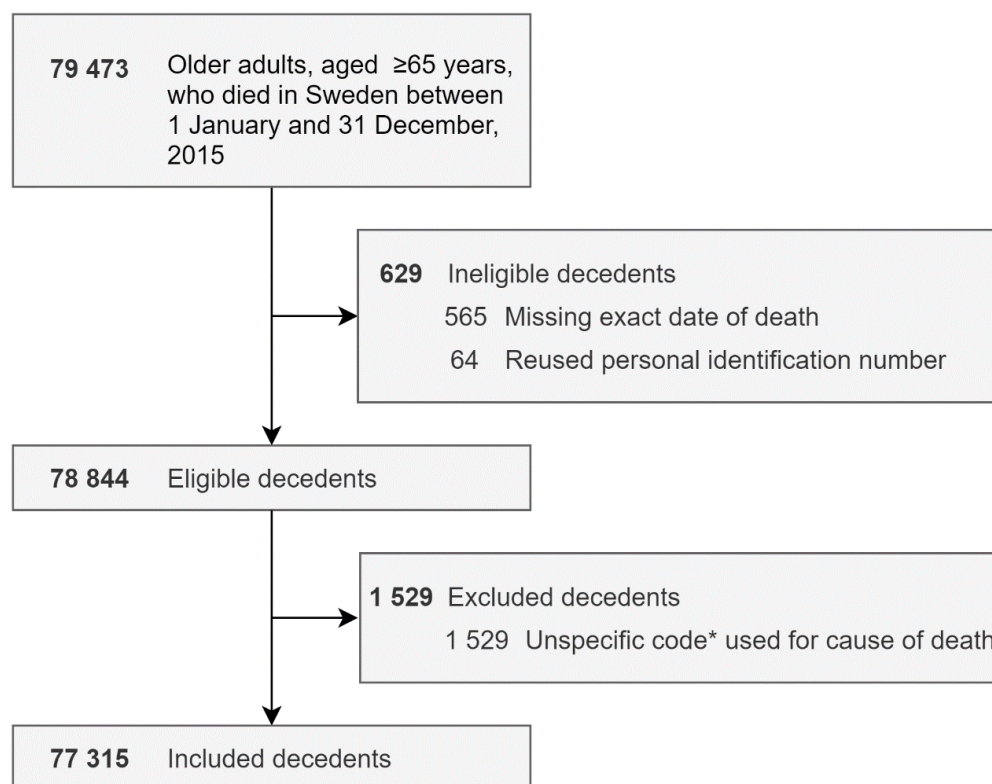


eFigure 2. Normal quintiles-quintiles plot of the number of unplanned admission throughout the entire last year of life



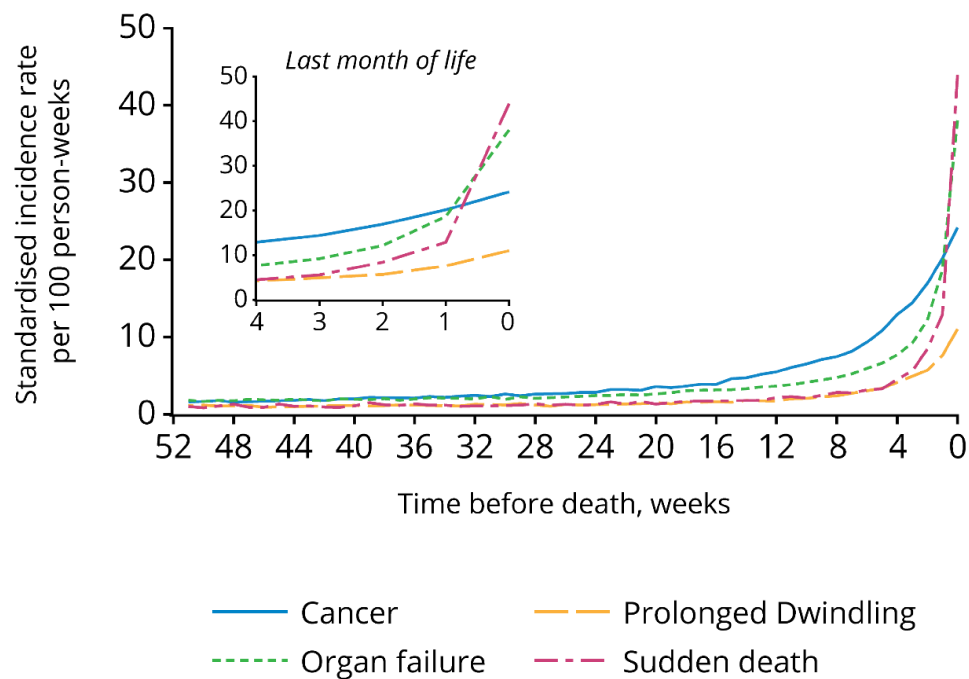
eFigure 3. Fitted probabilities under Zero-inflated Poisson and Poisson models plotted against each other



eFigure 4. Flowchart diagram

*Unspecific ICD-10 codes are B99, R96, R98, and R99

eFigure 5. Incidence rate of unplanned hospitalisation by week, stratified by illness trajectories in the last year of life, sex- and age-standardised (direct standardization).



eFigure 6. Crude Incidence rate of unplanned hospitalisation by week, stratified by illness trajectories in the last year of life, decedents with potentially unexpected cause of death are removed

