
Supplementary information

The epidemiology of type 1 diabetes mellitus in older adults

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Supplementary Table 1: Detailed summary of studies reporting incidence of type 1 diabetes in older adults aged ≥ 60 years

Author year	Country Region	Data type	Years of data	Total type 1 diabetes cohort	Age group (Years)	Incidence (95% CI) (per 100,000 per year)	Diagnosis method or criteria
Thunander et al 2008 ¹	Sweden Kronoberg	Primary Health Centre and two hospitals in Kronoberg	1998–2001	161 (incident cases)	60–69 70–79 80–100 60–69 70–79 80–100	Men 32.1 (28.4–36.0) 38.3 (33.9–43.0) 27.0 (22.0–32.8) Women 38.3 (34.4–42.5) 65.1 (55.9–66.4) 27.4 (23.4–31.8)	Positive for islet cell antibodies or GAD antibodies, or with a C-peptide value <0.25 nmol/L
Jiang et al 2012 ²	Taiwan	National Health Insurance	2008–2009	8,043	60–79 ≥ 80 60–79 ≥ 80	2008 0.22 0.00 2009 0.48 0.00	History of diabetic ketoacidosis. Positive glucagon test and GAD antibodies
Lin et al 2014 ³	Taiwan	Taiwan's National Health Insurance Research	2007–2010	7,225 (incident cases)	≥ 60	2007–2008 Men 0.23 Women 0.12 2009–2010 Men 0.29 Women	History of diabetic ketoacidosis. Positive glucagon test and GAD antibodies

						0.67	
Rogers et al 2017 ⁴	US	Clinformatics® Data Mart Database, MN	2001–2015	32,476	60–64	Per 100,000 person-years 29.2 (28.0–30.4)	Minimum of 2 type 1 diabetes billing codes, plus continuous insulin use (first 6 months after diagnosis, some other drugs were allowed)
Weng et al 2018 ⁵	China	13 areas of mainland China chosen from administrative areas (northeast, north, northwest, southwest, central, east, and south)	2010–2013	5,018 (incident cases)	60–64 65–69 70–74 ≥75	Per 100,000 person-years 0.44 (0.36–0.53) 0.38 (0.29–0.49) 0.32 (0.23–0.43) 0.37 (0.27–0.51)	Physician-diagnosed
Carstensen et al 2020 ⁶	Denmark	National Patient Register, prescription database, health insurance database, diabetes quality database, and eye screening database	2015–2016	343,952	60–69 70–79 ≥ 80 60–69 70–79 ≥ 80 60–69 70–79 ≥ 80	2015 Men 7 8 5 Women 9 10 2 2016 Men 13 5 0	Algorithm incorporating clinical diagnosis (ICD codes) from the hospitalisations or outpatient clinics, prescription of anti- diabetic medications, clinical and billing records

					60–69 70–79 ≥ 80	Women 8 6 4	
Gajewska et al 2020 ⁷	Ireland	Health Service Executive Pharmacy Claims Reimbursement Scheme	2016	1,527 (incident cases)	65–74 ≥ 75	41.2 54.2	Clinical guidelines and treatment based Klompas ⁸ algorithm: Co-prescription of insulin and glucometer test strips without any prolonged course (>12 months) of oral hypoglycaemic agents prior to starting insulin
Luk et al 2020 ⁹	Hong Kong	Hong Kong Diabetes Surveillance Database	2013–2015	2,426	≥ 60	2013 Men 0.73 Women 0.93 2014 Men 1.83 Women 0.64 2015 Men 1.75 Women 1.09	Type 1 diabetes was defined as clinical presentation with diabetic ketoacidosis and/or continuous requirement of insulin within 1 year of diagnosis. Also, ratios of ICD-10 codes of type 1 to type 2 diabetes codes ≥4 or prescription of a combination of short- and long-acting insulin and no noninsulin anti-hyperglycaemic treatment within the first year of diagnosis

Nishioka et al 2020 ¹⁰	Japan	National Database of Health Insurance Claims and Specific Health Check-ups of Japan	2014–2017	10,400 (incident cases)	≥ 60	Per 100,000 person-years Men 3.48 Women 3.31	Type 1-specific ICD code and use of insulin
Liu et al 2021 ¹¹	China	Beijing Municipal Health Commission Information Center	2007–2017	6,875	≥ 75	Per 100,000 person-years 1.49 (0.97–2.29)	ICD-10-CM code E10 and symptoms, signs, history, long-term application of insulin (>1 year), no other antidiabetic drug use before and 1 year after the diagnosis, absence of islet function, age of diagnosis, and/or positive autoantibodies (markers of the immune destruction of the β-cell including islet cell autoantibodies, autoantibodies to insulin, and autoantibodies to GAD)
Rodríguez Escobedo et al 2023 ¹²	Spain, Asturias	Registry and hospital data	2011–2020	815	≥ 60	Men 3.14 (2.28–4.21) Women 4.44 (3.52–5.47)	A combination of people with anti-GAD, anti-IA2 and anti-Zn from pancreatic autoimmunity registry (who were validated to have type 1 diabetes), hospital admission for type 1 diabetes and people of Hospital Universitario Central de Asturias type 1 diabetes registry

CI = confidence interval; GAD = glutamic acid decarboxylase; IA2 = islet antigen 2; ICA = islet cell antibodies; ICD = International Classification of Diseases; ICD-10-CM = International Classification of Diseases, Tenth Revision, Clinical Modification. Data in parenthesis represent 95% confidence intervals.

Supplementary Table 2: Detailed summary of studies reporting prevalence of type 1 diabetes in older adults aged ≥ 60 years

Author year	Country Region	Data type	Years of data	Total type 1 diabetes cohort	Age groups years	Prevalence (95% CI)	Diagnosis method or criteria
Ostrauskas et al 2007 ¹³	Lithuania	National Register of Diabetes Mellitus in Childhood	2001–2004	2,179	60–64 65–69 70–74 60–64 65–69 70–74 60–64 65–69 70–74 60–64 65–69 70–74	2001 Men 0.07% 0.05% 0.01% Women 0.05% 0.03% 0.02% 2004 Men 0.11% 0.06% 0.06% Women 0.06% 0.05% 0.04%	Insulin requirement

Jiang et al 2012 ²	Taiwan	National Health Insurance	2000–2009	8,043	≥ 60	2008 0.004% 2009 0.005%	History of diabetic ketoacidosis. Positive glucagon test and GAD antibodies
Menke et al 2013 ¹⁴	US	National Health and Nutrition Examination Survey	1999–2010	59,130	≥ 60	Weighted proportion 0.08 (0.02–0.18)	Self-report
Bullard et al 2018 ¹⁵	US	National Health and Interview Survey	2016	182 Representing 1.3 million	≥ 65	0.65% (0.48–0.88)	Self-report
Xu et al 2018 ¹⁶	US	National Health and Interview Survey	2016–2017	58,186	≥ 65	Weighted proportion 0.6 (0.5–0.8)	Self-report
Campbell et al 2020 ¹⁷	Scotland	Scottish Care Information – Diabetes Extract	2011–2015	143,123	60–79 ≥ 80	0.41% 0.18%	Algorithm including Read codes
Carstensen et al 2020 ⁶	Denmark	National Patient Register, prescription database, health insurance database, diabetes quality database, and eye screening database	2015–2016	29,797	60–69 70–79 ≥ 80 60–69 70–79 ≥ 80 60–69 70–79 ≥ 80	2015 Men 0.72% 0.61% 0.36% Women 0.53% 0.45% 0.32% 2016 Men 0.73% 0.60% 0.38%	Algorithm incorporating clinical diagnosis (ICD codes) from the hospitalisations or outpatient clinics, prescription of anti-diabetic medications, clinical and billing records

					60–69 70–79 ≥ 80	Women 0.55% 0.45% 0.31%	
Gajewska et al 2020 ⁷	Ireland	Health Service Executive Pharmacy Claims Reimbursement Scheme	2016	20,081	65–74 ≥ 75	0.72% (0.69–0.75) 0.74% (0.71–0.77)	Clinical guidelines and treatment based Klompas ⁸ algorithm: Co-prescription of insulin and glucometer test strips without any prolonged course (>12 months) of oral hypoglycaemic agents prior to starting insulin

CI = confidence interval; GAD = glutamic acid decarboxylase; ICD = International Classification of Diseases. Data in parenthesis represent 95% confidence intervals.

Supplementary Table 3: Detailed summary of studies reporting mortality of type 1 diabetes mellitus in older adults aged ≥ 60 years

Author year	Country Region	Data type	Years of data	Total type 1 diabetes cohort	Age groups years	Mortality	Diagnosis method or criteria
Soedamah-Muthu et al 2006 ¹⁸	UK	General Practice Research Database (GPRD)	1992–1999	7,713	66–75 ≥76 66–75 ≥76	Mortality per 1,000 person-years Men 42.4 (29.5–61.0) 22.4 (18.0–27.9) Women 44.1 (29.8–65.3) 136.6 (83.7–223.0)	An algorithm including Read codes and diagnosis of type 1 diabetes < 35 years. Algorithm was validated
Harding et al 2014 ¹⁹	Australia	National registry	1997–2010	86,800	60–69	Standardised Mortality Ratio Men 2.60 (2.36–2.87)	Clinical diagnosis modified by: Type 1 status assigned in registrants who were

		National Diabetes Service Scheme			70–79 80–89 60–69 70–79 80–89	2.25 (1.81–2.80) 2.13 (1.59–2.84) Women 3.40 (3.00–3.87) 3.12 (0.56–5.36) 2.52 (1.81–3.54)	classified as type 1 on the NDSS and were diagnosed before the age of 30 years, and the time between diagnosis date and date of first insulin use was less than 1 year. When data on date of diagnosis or insulin initiation date was missing, people were classified as having type 1 diabetes if they were recorded as type 1 on the registry, were taking insulin, and were registered at <45 years of age
Lin et al 2014 ³	Taiwan	Taiwan's National Health Insurance Research	1999–2010	7,225 (incident cases)	≥ 60	Standardised Mortality Ratio Men 0.93 (0.77–1.10) Women 1.28 (1.06–1.50)	History of diabetic ketoacidosis. Positive glucagon test and GAD antibodies
Livingstone et al 2015 ²⁰	Scotland	Scottish Care Information – Diabetes Collaboration	2008–2010	24,691	60–64 65–69 70–74 75–79 ≥ 80 60–64 65–69	Mortality, per 1,000 person-years Men 31.9 45.3 81.1 82.4 142.7 Women 24.2 32.2	Physician-diagnosed type 1 diabetes

					70–74 75–79 ≥ 80 60–64 65–69 70–74 75–79 ≥ 80 60–64 65–69 70–74 75–79 ≥ 80	64.1 97.7 171.3 Life expectancy from age, difference in LE from general pop (years) Men 15.5 (14.5–16.0) 5.6 12.4 (11.6–13.3) 4.6 9.9 (9.2–10.7) 3.6 8.8 (8.1–9.5) 1.6 7.0 (6.5–7.7) 0.8 Women 23.4(23.3–23.5) 7.1 19.3(19.2–19.3) 6.3 15.5(15.4–15.5) 5.7 12.0 (11.9–12.0) 4.4 9.0 (8.9–9.0) 3.2	
Harding et al 2016 ²¹	Australia	National registry National Diabetes Service Scheme	2009–2011	86,800	60–85	Mortality, per 1,000 person- years 2009 Men 24.95 Women 23.55 2010 Men 27.95	Clinical diagnosis modified by: Type 1 status assigned in registrants who were classified as type 1 on the NDSS and were diagnosed before the age of 30 years, and the time between diagnosis date and date of first insulin use was less than 1 year. When data on date of diagnosis or insulin initiation date was missing, people were classified people as having

						Women 23.35 2011 Men 27.95 Women 22.64	type 1 diabetes if they were recorded as type 1 on the registry, were taking insulin, and were registered at <45 years of age
Petrie et al 2016 ²²	Sweden	Swedish National Diabetes Register (NDR)	2002–2011	27,841	60 70 80 60 70 80	Life expectancy (years) from age Men 22.4 13.7 8.9 Women 26.7 17.7 10.11	Type 1 diabetes assigned if diagnosed under the age of 30 years, reported as being treated with insulin only at clinic visit, and having had at least one prescription for insulin filled per year between 2006 and 2010 (full calendar years where prescription data were available) and without a prescription filled for metformin at any point between July 2005 and December 2010
Carstensen et al 2020 ⁶	Denmark	National Patient Register, prescription database, health insurance database, diabetes quality database, and	2015–2016	343,952	60–69 70–79 ≥ 80 60–69 70–79	Mortality, per 1,000 per year 2015 Men 28.8 63.3 159.7 Women 23.0 48.0	Algorithm incorporating clinical diagnosis (ICD codes) from the hospitalisations or outpatient clinics, prescription of anti-diabetic medications, clinical and billing records

		eye screening database			≥ 80 60–69 70–79 ≥ 80 60–69 70–79 ≥ 80	175.7 2016 Men 28.5 48.7 175.2 Women 24.3 36.9 158.8	
Thunander et al 2020 ²³	Sweden Kronoberg	Diabetes Incidence in Kronoberg (DIK) study Primary Health Centre and two hospitals in Kronoberg	1998–2014	1,609	60–69 70–79 80–89 90–100	Standardised Mortality Ratio at 15 years after diagnosis (95% CI) 0.93 (0.29–2.24) 0.80 (0.43–1.36) 1.06 (0.46–2.09) 1.06 (0.46–2.09)	Positive for islet cell antibodies or GAD antibodies, or with a C-peptide value <0.25 nmol/L
Arffman et al 2023 ²⁴	Finland	National registry Diabetes in Finland database	2017	42,936	60–64 65–69 70–74 75–79 ≥80 60 70	Mortality per 1,000 per year 25.5 24.5 32.4 76.4 N/A due to small numbers Remaining life expectancy (years) from age 18.6 12.8	Type 1 status assigned according to primary diagnosis codes from first year on database including medication codes and codes from primary health care data. Individuals also had an age of onset <29 years

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CI = confidence intervals; ICD = International Classification of Diseases; GAD = glutamic acid decarboxylase; NDSS = National Diabetes Services Scheme. Data in parenthesis represent 95% confidence intervals.

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