

Supplementary Information

Association between Cardiovascular Diseases and Dementia among various age groups: A Population-Based Cohort Study in Older Adults

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	ICD-9 codes	ICD-10 codes
Hypertension	401	I10
Diabetes	250.x	E08, E10, E11, E13
Dyslipidemia	272	E78
Stroke		
<i>Hemorrhagic stroke intracranial (non-traumatic)</i>	430, 431, 432.x	I60, I61, I62
<i>Ischaemic stroke</i>	433.xx, 434.xx, 436.0, 436.9	I63 except I63.6, I64
<i>Transient ischemic attack</i>	435.x	G45
Myocardial infarction	410.xx	I21, I22, I23
Chronic heart failure	428.0, 428.1, 428.9	I50, I50.1, I50.9
Atrial fibrillation	427.3	I48
Major bleeding		
-Intracranial major bleeding		
<i>Intracranial bleeding</i>	430, 431, 432.x, 852.x, 853.x	I60, I61, I62, S06.3, S06.4, S06.5, S06.6
-Major gastrointestinal bleeding		
<i>Upper gastrointestinal bleeding (only using Med-Echo)</i>	456.1, 530.7, 531.0x, 531.2x, 531.4x, 531.6x, 532.0x, 532.2x, 532.4x, 532.6x, 533.0x, 533.2x, 533.4x, 533.6x, 534.0x, 534.2x, 534.4x, 534.6x, 535.1, 578.0	I85.0, K22.6, K25.0, K25.2, K25.4, K25.6, K26.0, K26.2, K26.4, K26.6, K27.0, K27.2, K27.4, K27.6, K28.0, K28.2, K28.4, K28.6, K29.0, K92.0
<i>Upper gastrointestinal bleeding (only using RAMQ)</i>	456.1, 530.7, 531.0x, 531.2x, 531.4x, 531.6x, 532.0x, 532.2x, 532.4x, 532.6x, 533.0x, 533.2x, 533.4x, 533.6x, 534.0x, 534.2x, 534.4x, 534.6x, 535.1, 578.0 RAMQ ICD-9 at an emergency room and procedure endoscopic control of gastric or duodenal bleeding or upper gastrointestinal endoscopy including esophagus, stomach, and either the duodenum and/or jejunum as appropriate with control of bleeding, any method (code 00691) within 7 days	I85.0, K22.6, K25.0, K25.2, K25.4, K25.6, K26.0, K26.2, K26.4, K26.6, K27.0, K27.2, K27.4, K27.6, K28.0, K28.2, K28.4, K28.6, K29.0, K92.0 RAMQ ICD-9 at an emergency room and procedure endoscopic control of gastric or duodenal bleeding or upper gastrointestinal endoscopy including esophagus, stomach, and either the duodenum and/or jejunum as appropriate with control of bleeding, any method (00691) within 7 days

<i>Lower gastrointestinal bleeding</i>	562.02, 562.03, 562.12, 562.13, 569.3x, 569.85, 578.1x, 578.9	K57.11, K57.13, K57.31, K57.33, K62.5, K55.21, K92.1, K92.2
-Other critical sites of major bleeding		
<i>Gross hematuria</i>	599.7	R31
<i>Hemoptysis</i>	786.3x	R04.2, R04.89, R04.9
<i>Vitreous hemorrhage</i>	379.23	H43.13
<i>Urogenital bleed</i>	626.2x and 280.0, 285.1 or 285.9	N92.0 and D50.0, D62, D64.9)
<i>Hemarthrosis</i>	719.1x	M25.0x
<i>Hemopericardium</i>	423.0	I31.2
<i>Hemoperitoneum</i>	568.8	K66.1
<i>Hemorrhage not specified</i>	459.0x	R58.0
<i>Acute posthemorrhagic anemia</i>	285.1x	D62
-Systemic embolism	444.x, 557.0, 362.31, 362.32, 598.31	I74
<i>Arterial embolism and thrombosis</i>	444.x	I74.0, I74.1, I74.2, I74.3, I74.5, I74.8, I74.9
<i>Ischemic colitis or mesenteric thromboembolism</i>	557.0	K55.0
<i>Retinal artery thromboembolism</i>	362.31, 362.32	H34.1, H34.2
<i>Renal artery thromboembolism</i>	593.81	N28.0
Peripheral arterial disease	440 (except 440.0), 441, 443.0, 443.89, 443.9	I70.1 to I70.9, I71, I73.0, I73.89, I73.9
Chronic kidney disease (moderate to severe disease)	404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 580.0, 580.4, 581.0, 581.1, 581.2, 581.3, 581.89, 581.9, 582.0, 582.1, 582.2, 582.89, 582.9, 583.0, 583.1, 583.2, 583.4, 583.7, 583.6, 583.89, 583.9, 584.5, 584.6, 584.7, 584.8, 584.9, 585.1, 585.2, 585.3, 585.4, 585.5, 585.6, 586, 590.0, 590.01, 590.80	I12, I13, N00, N01, N02, N03, N04, N05, N07, N11, N12, N14, N17, N18, N19

Table S1. Definition of cardiovascular risk factors or diseases according to ICD-9 and ICD-10 from Med-Echo databases or RAMQ medical service files.

ICD-9 International Classification of Diseases - 9th Revision, *ICD-10* International Classification of Diseases - 10th Revision, *RAMQ* Régie de l'assurance maladie du Québec, *Med-Echo* Administrative databases of hospital discharge reports.

	Age group 66–69		Age group 70–74	
	HR (95% CI)		HR (95% CI)	
Risk factors	Model 1 Adjusted for age and sex [†]	Model 2 Multivariate [‡]	Model 1 Adjusted for age and sex [†]	Model 2 Multivariate [‡]
Hypertension	1.05 (0.93–1.20)	0.85 (0.75–0.98)	1.12 (1.07–1.18)	0.98 (0.93–1.03)
Diabetes mellitus	2.03 (1.76–2.35)	1.84 (1.58–2.13)	1.71 (1.62–1.81)	1.58 (1.49–1.68)
Dyslipidemia	1.28 (1.10–1.49)	1.04 (0.88–1.22)	1.21 (1.14–1.29)	1.01 (0.95–1.08)
Stroke	4.16 (3.37–5.15)	3.54 (2.83–4.42)	2.57 (2.35–2.82)	2.19 (1.99–2.41)
Myocardial infarction	1.53 (1.11–2.11)	0.89 (0.63–1.26)	1.55 (1.37–1.75)	1.02 (0.90–1.17)
Chronic heart failure	2.87 (2.26–3.65)	2.08 (1.57–2.74)	2.33 (2.12–2.56)	1.76 (1.58–1.96)
Atrial fibrillation	1.75 (1.32–2.30)	1.12 (0.83–1.51)	1.66 (1.51–1.83)	1.24 (1.12–1.37)
	Age group 75–79		Age group 80–84	
	HR (95% CI)		HR (95% CI)	
Risk factors	Model 1 Adjusted for age and sex [†]	Model 2 Multivariate [‡]	Model 1 Adjusted for age and sex [†]	Model 2 Multivariate [‡]
Hypertension	1.08 (1.05–1.12)	0.99 (0.96–1.02)	1.07 (1.04–1.09)	0.99 (0.96–1.02)
Diabetes mellitus	1.46 (1.41–1.51)	1.39 (1.34–1.44)	1.32 (1.28–1.36)	1.27 (1.23–1.30)
Dyslipidemia	1.18 (1.14–1.23)	1.02 (0.98–1.06)	1.15 (1.12–1.19)	1.01 (0.98–1.05)
Stroke	1.92 (1.81–2.03)	1.73 (1.63–1.84)	1.64 (1.57–1.72)	1.52 (1.45–1.60)
Myocardial infarction	1.39 (1.29–1.50)	1.07 (0.98–1.16)	1.24 (1.17–1.32)	1.01 (0.95–1.08)
Chronic heart failure	1.70 (1.60–1.80)	1.38 (1.29–1.47)	1.49 (1.43–1.56)	1.29 (1.23–1.35)
Atrial fibrillation	1.47 (1.40–1.55)	1.23 (1.17–1.31)	1.38 (1.33–1.43)	1.22 (1.17–1.27)
	Age group 85–89		Age group ≥ 90	
	HR (95% CI)		HR (95% CI)	
Risk factors	Model 1 Adjusted for age and sex [†]	Model 2 Multivariate [‡]	Model 1 Adjusted for age and sex [†]	Model 2 Multivariate [‡]
Hypertension	1.04 (1.01–1.07)	0.99 (0.96–1.02)	1.14 (1.09–1.18)	1.10 (1.06–1.14)
Diabetes mellitus	1.26 (1.22–1.31)	1.23 (1.18–1.27)	1.23 (1.17–1.29)	1.20 (1.14–1.26)
Dyslipidemia	1.10 (1.06–1.14)	0.98 (0.95–1.02)	1.11 (1.05–1.17)	1.01 (0.95–1.07)
Stroke	1.40 (1.33–1.48)	1.34 (1.27–1.41)	1.20 (1.11–1.28)	1.13 (1.05–1.21)
Myocardial infarction	1.21 (1.14–1.29)	1.07 (0.99–1.14)	1.11 (1.03–1.21)	0.99 (0.91–1.08)
Chronic heart failure	1.31 (1.25–1.36)	1.18 (1.12–1.24)	1.18 (1.12–1.24)	1.08 (1.02–1.14)
Atrial fibrillation	1.26 (1.21–1.31)	1.15 (1.11–1.21)	1.23 (1.17–1.29)	1.16 (1.10–1.22)

Table S2. Association between the cardiovascular risk factors or diseases and dementia risk with Cox regression models.

HR hazard ratio, *CI* confidence interval.

[†] Model 1: Cox regression model adjusted for age and sex.

[‡] Model 2: Cox regression model adjusted for age, sex and all cardiovascular risk factors or diseases.

	Age group 66–69		Age group 70–74	
	HR (95% CI)		HR (95% CI)	
	Model 1 [†]	Model 2 [‡]	Model 1 [†]	Model 2 [‡]
Risk factors	Adjusted for age and sex	Multivariate	Adjusted for age and sex	Multivariate
Hypertension	1.05 (0.93–1.20)	0.84 (0.73–0.96)	1.12 (1.07–1.18)	0.96 (0.91–1.01)
Diabetes mellitus	2.03 (1.76–2.35)	1.73 (1.48–2.03)	1.71 (1.62–1.81)	1.48 (1.40–1.57)
Dyslipidemia	1.28 (1.10–1.49)	1.02 (0.86–1.20)	1.21 (1.14–1.29)	0.96 (0.90–1.03)
Stroke	4.16 (3.37–5.15)	3.33 (2.63–4.20)	2.57 (2.35–2.82)	1.92 (1.74–2.13)
Myocardial infarction	1.53 (1.11–2.11)	0.87 (0.61–1.23)	1.55 (1.37–1.75)	0.95 (0.83–1.09)
Chronic heart failure	2.87 (2.26–3.65)	1.88 (1.42–2.51)	2.33 (2.12–2.56)	1.55 (1.39–1.73)
Atrial fibrillation	1.75 (1.32–2.30)	1.09 (0.80–1.46)	1.66 (1.51–1.83)	1.19 (1.08–1.32)
Major bleeding	1.97 (1.49–2.62)	1.48 (1.11–1.97)	1.67 (1.49–1.87)	1.34 (1.19–1.51)
Systemic embolism	1.98 (1.03–3.82)	1.01 (0.51–2.00)	2.13 (1.68–2.71)	1.08 (0.85–1.39)
Peripheral artery disease	1.84 (1.46–2.33)	1.01 (0.77–1.33)	2.03 (1.87–2.20)	1.43 (1.30–1.57)
Chronic kidney disease	2.56 (2.06–3.24)	1.46 (1.13–1.89)	2.25 (2.07–2.45)	1.47 (1.34–1.62)
	Age group 75–79		Age group 80–84	
	HR (95% CI)		HR (95% CI)	
	Model 1 [†]	Model 2 [‡]	Model 1 [†]	Model 2 [‡]
Risk factors	Adjusted for age and sex	Multivariate	Adjusted for age and sex	Multivariate [‡]
Hypertension	1.08 (1.05–1.12)	0.97 (0.94–1.00)	1.07 (1.04–1.09)	0.98 (0.95–1.00)
Diabetes mellitus	1.46 (1.41–1.51)	1.33 (1.28–1.38)	1.32 (1.28–1.36)	1.24 (1.20–1.27)
Dyslipidemia	1.18 (1.14–1.23)	0.98 (0.94–1.02)	1.15 (1.12–1.19)	0.98 (0.95–1.02)
Stroke	1.92 (1.81–2.03)	1.61 (1.52–1.71)	1.64 (1.57–1.72)	1.47 (1.40–1.54)
Myocardial infarction	1.39 (1.29–1.50)	1.01 (0.94–1.10)	1.24 (1.17–1.32)	0.98 (0.92–1.05)
Chronic heart failure	1.70 (1.60–1.80)	1.27 (1.19–1.36)	1.49 (1.43–1.56)	1.23 (1.17–1.29)
Atrial fibrillation	1.47 (1.40–1.55)	1.20 (1.13–1.27)	1.38 (1.33–1.43)	1.20 (1.15–1.25)
Major bleeding	1.52 (1.41–1.63)	1.31 (1.22–1.41)	1.28 (1.20–1.35)	1.13 (1.06–1.20)
Systemic embolism	1.51 (1.28–1.78)	0.99 (0.84–1.18)	1.16 (0.99–1.35)	0.88 (0.75–1.03)
Peripheral artery disease	1.56 (1.49–1.65)	1.23 (1.16–1.30)	1.35 (1.29–1.40)	1.15 (1.10–1.20)
Chronic kidney disease	1.71 (1.63–1.80)	1.31 (1.24–1.39)	1.43 (1.37–1.48)	1.18 (1.13–1.23)
	Age group 85–89		Age group ≥ 90	
	HR (95% CI)		HR (95% CI)	
	Model 1 [†]	Model 2 [‡]	Model 1 [†]	Model 2 [‡]
Risk factors	Adjusted for age and sex	Multivariate	Adjusted for age and sex	Multivariate
Hypertension	1.04 (1.01–1.07)	0.98 (0.95–1.01)	1.14 (1.09–1.18)	1.08 (1.04–1.13)
Diabetes mellitus	1.26 (1.22–1.31)	1.20 (1.16–1.25)	1.23 (1.17–1.29)	1.18 (1.12–1.24)
Dyslipidemia	1.10 (1.06–1.14)	0.95 (0.91–0.99)	1.11 (1.05–1.17)	0.98 (0.92–1.03)
Stroke	1.40 (1.33–1.48)	1.30 (1.23–1.37)	1.20 (1.11–1.28)	1.10 (1.03–1.19)
Myocardial infarction	1.21 (1.14–1.29)	1.03 (0.97–1.10)	1.11 (1.03–1.21)	0.97 (0.89–1.05)
Chronic heart failure	1.31 (1.25–1.36)	1.13 (1.08–1.19)	1.18 (1.12–1.24)	1.04 (0.98–1.10)
Atrial fibrillation	1.26 (1.21–1.31)	1.13 (1.09–1.18)	1.23 (1.17–1.29)	1.14 (1.08–1.20)
Major bleeding	1.22 (1.15–1.30)	1.11 (1.04–1.19)	1.10 (1.02–1.19)	1.02 (0.94–1.10)
Systemic embolism	1.36 (1.17–1.59)	1.11 (0.95–1.30)	1.02 (0.81–1.29)	0.84 (0.67–1.07)
Peripheral artery disease	1.27 (1.21–1.33)	1.13 (1.08–1.19)	1.23 (1.16–1.31)	1.14 (1.07–1.21)
Chronic kidney disease	1.33 (1.27–1.38)	1.17 (1.12–1.22)	1.29 (1.22–1.36)	1.17 (1.11–1.24)

Table S3. Association between the cardiovascular risk factors or diseases and dementia risk with Cox regression models and including major bleeding, systemic embolism, peripheral artery disease and chronic kidney disease.

HR hazard ratio, *CI* confidence interval.

† Model 1: Cox regression model adjusted for age and sex.

‡ Model 2: Cox regression model adjusted for age, sex and all cardiovascular risk factors or diseases and including major bleeding, systemic embolism, peripheral artery disease and chronic kidney disease.

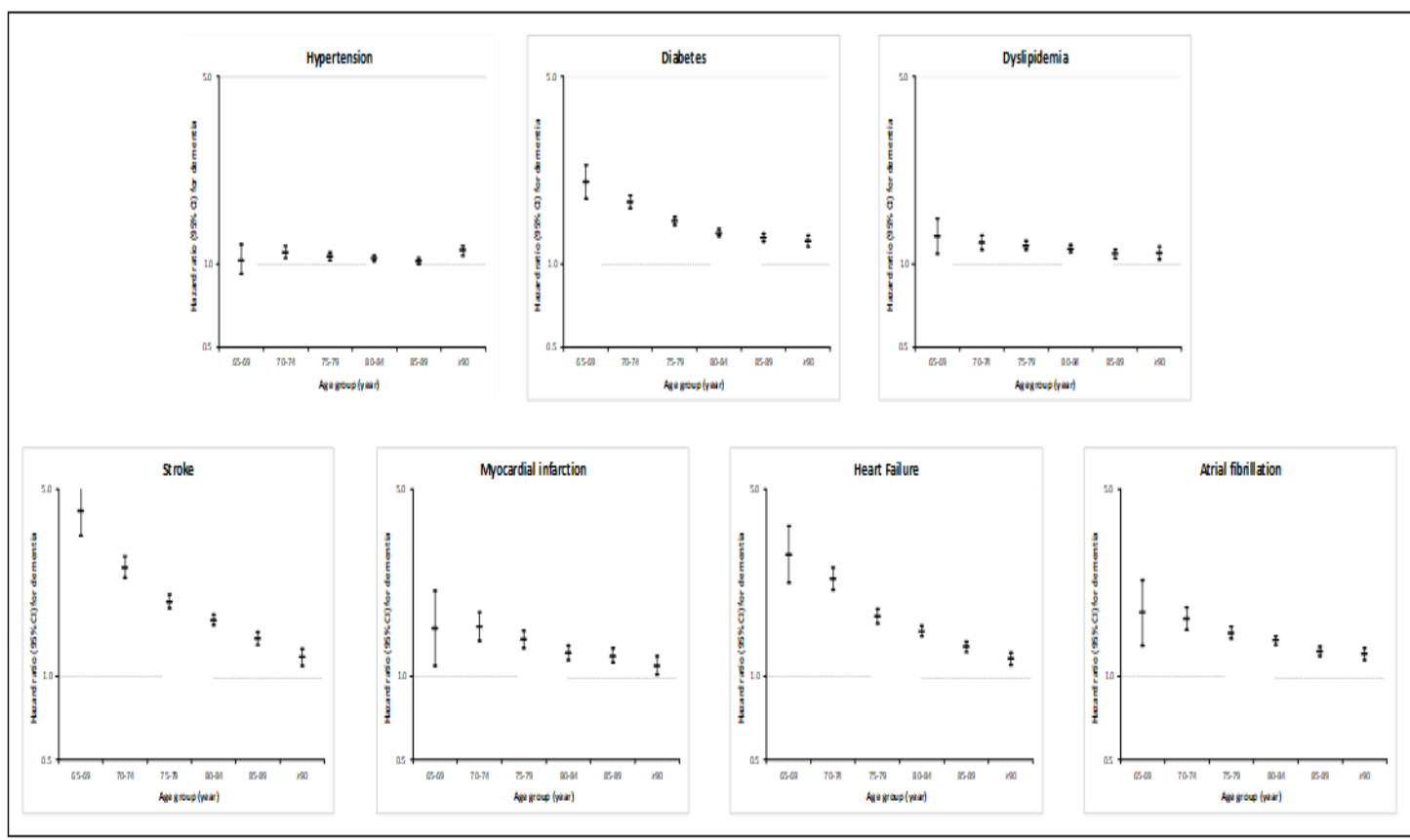


Figure S1. Risk of dementia in the presence of cardiovascular risk factors or diseases per 5-year age group (except for patients ≥ 90 , in which no upper age limit was used) determined with competing risks, adjusted for age at cohort entry and sex.