

Epidemiologia dell'ictus cerebrale

Tracking stroke epidemiology

Essential in order to *manage health services, to optimize economic resources, and to estimate the adequacy of the therapeutic strategies of primary and secondary prevention*

Moreover epidemiological studies allow *to extrapolate the expected number of patients* with cerebrovascular disease that can benefit of stroke units

GAZZETTA UFFICIALE

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DECRETO 2 aprile 2015, n. 70.

Regolamento recante definizione degli standard qualitativi, strutturali, tecnologici e quantitativi relativi all'assistenza ospedaliera. (15G00084).. Pag. 1

relativi all'assistenza ospedaliera. (15G00084).. Pag. 1

DECRETI, DELIBERE E ORDINANZE MINISTERIALI

Ministero dell'economia
e delle finanze

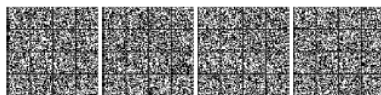
DECRETO 27 maggio 2015.

Individuazione dei criteri per la designazione, da parte dell'Associazione nazionale dei comuni italiani, dei componenti delle sezioni delle commissioni censuarie locali e centrale. (15A04315) Pag. 35

al laboratorio ARPAM - Agenzia regionale per la protezione ambientale delle Marche - Dipartimento provinciale di Macerata, al rilascio dei certificati di analisi nel settore vitivinicolo». (15A04133)..... Pag. 36

DECRETO 28 aprile 2015.

Annullamento del decreto 11 dicembre 2014, recante il «Rinnovo dell'autorizzazione al Laboratorio chimico merceologico azienda speciale della CCIAA di Napoli, al rilascio dei certificati di analisi nel settore vitivinicolo». (15A04135) . Pag. 37



The Impact of Stroke

4th/3rd leading cause of death in most Western countries

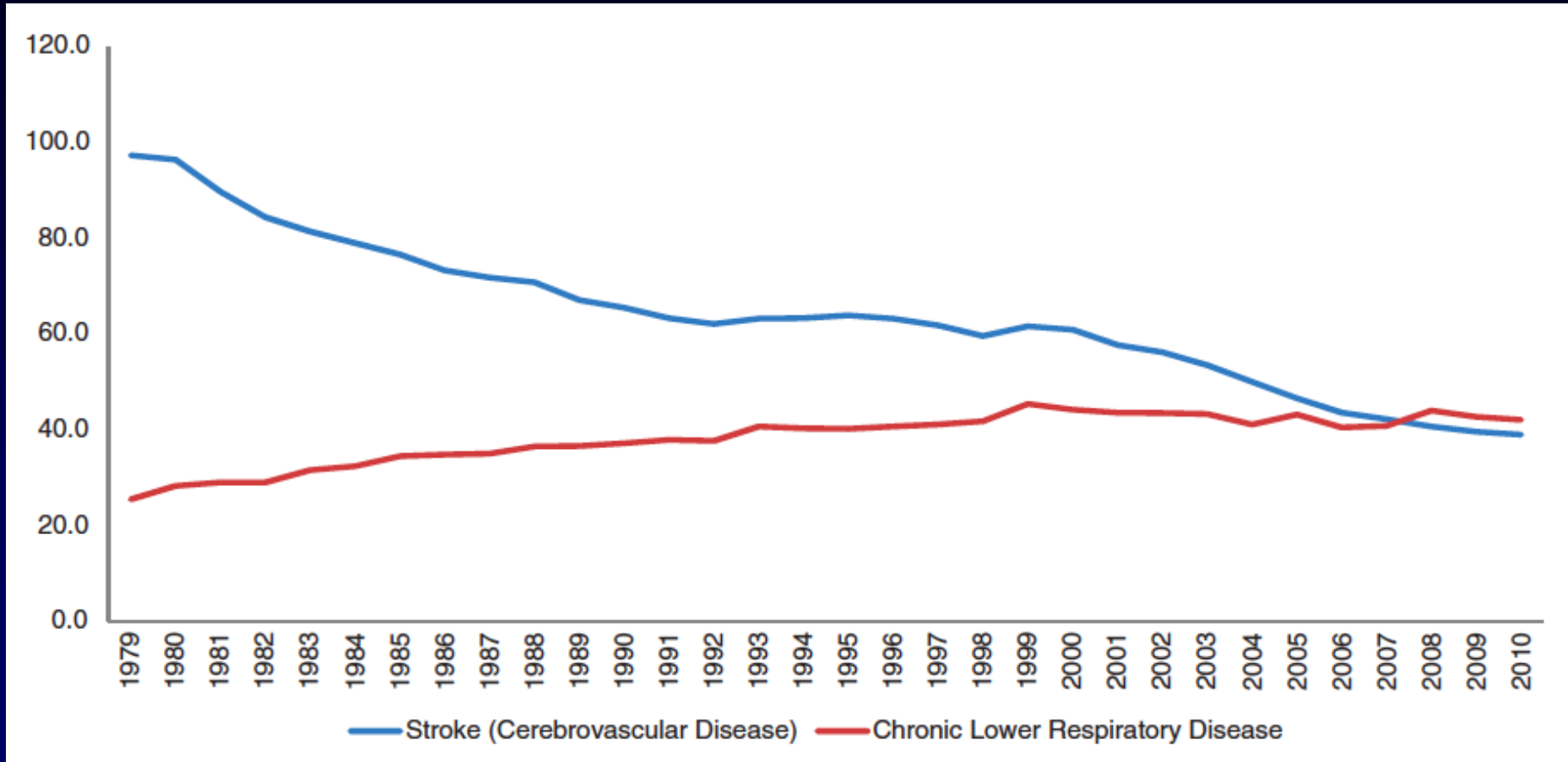
A leading cause of long-term disability

2nd most expensive illness

Significant economic burden in terms of health care costs and lost productivity

Most strokes are preventable

Age-adjusted death rates for CVD and CLRD



Stroke 2014;45:315-353

Worldwide stroke incidence and early case fatality reported
in 56 population-based studies: a systematic review

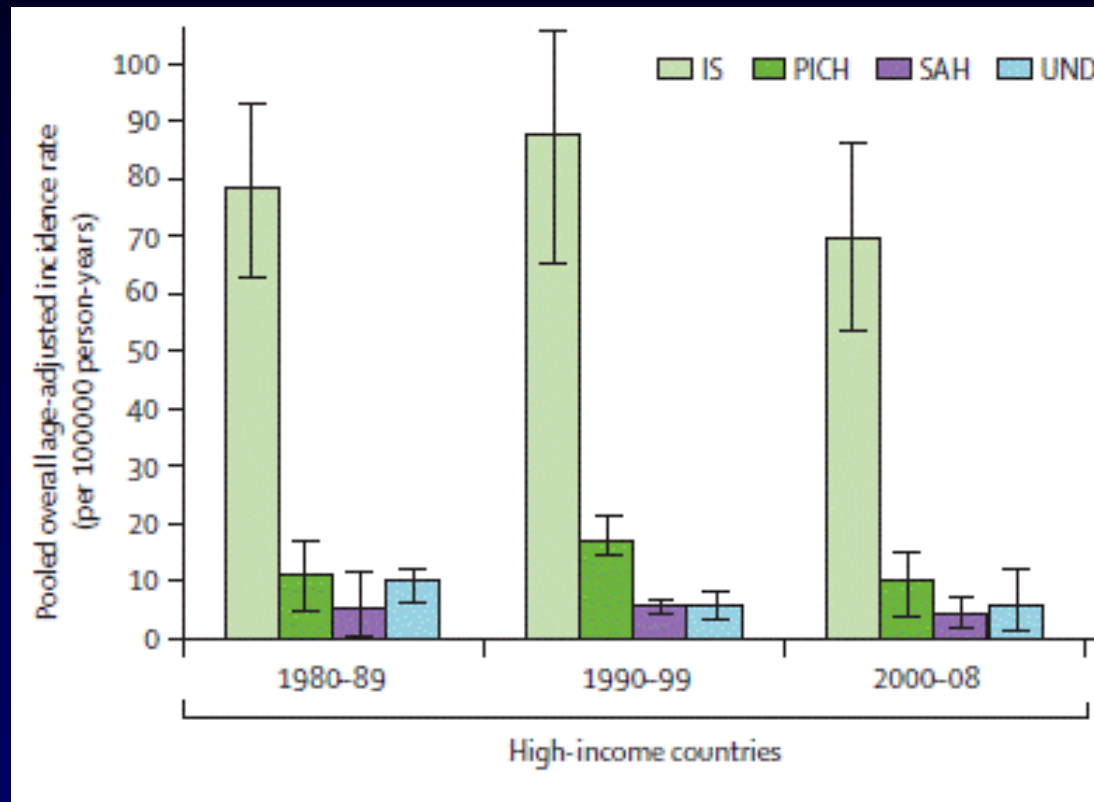
From the 1970s through 2008 the *age-adjusted stroke incidence rates* in high-income countries declined 42% overall with declines in each subsequent decade of the study

These trends were found across all age groups, with *a greater decline in those ≥ 75 years of age*

A greater than 100% increase in stroke incidence was found in low to middle income countries

Lancet Neurol 2009;8:355-369

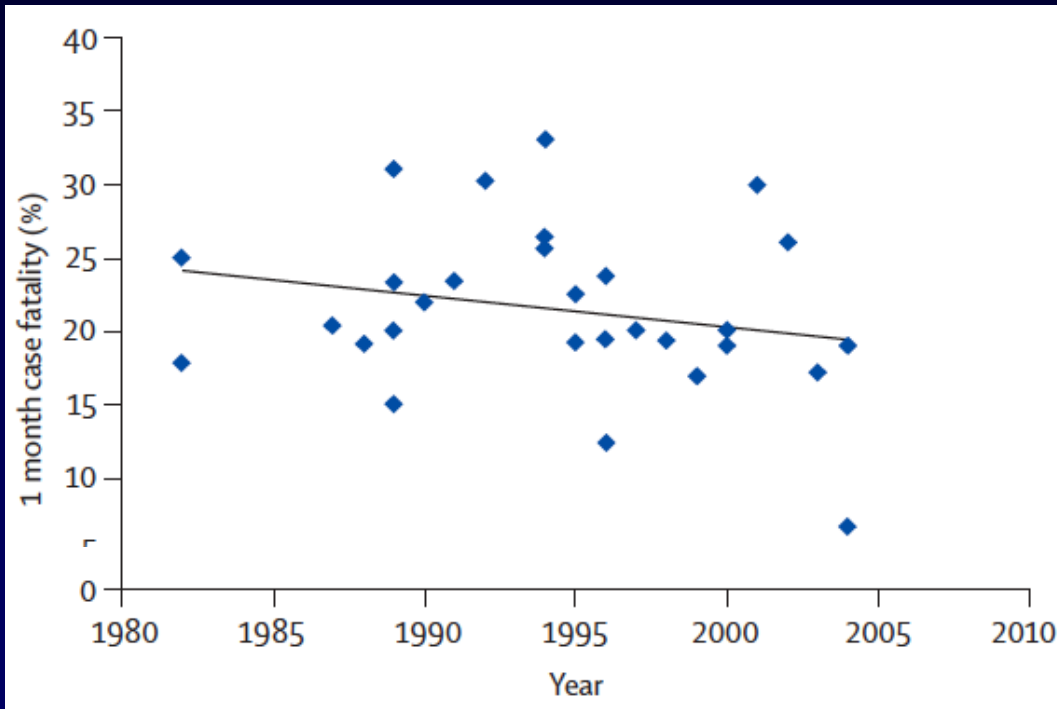
Incidence rates of stroke types in high-income countries



The pooled overall age-adjusted incidence rates of ischemic stroke fell by 11%, likely reflecting advances in primary prevention

Lancet Neurol 2009;8:355-369

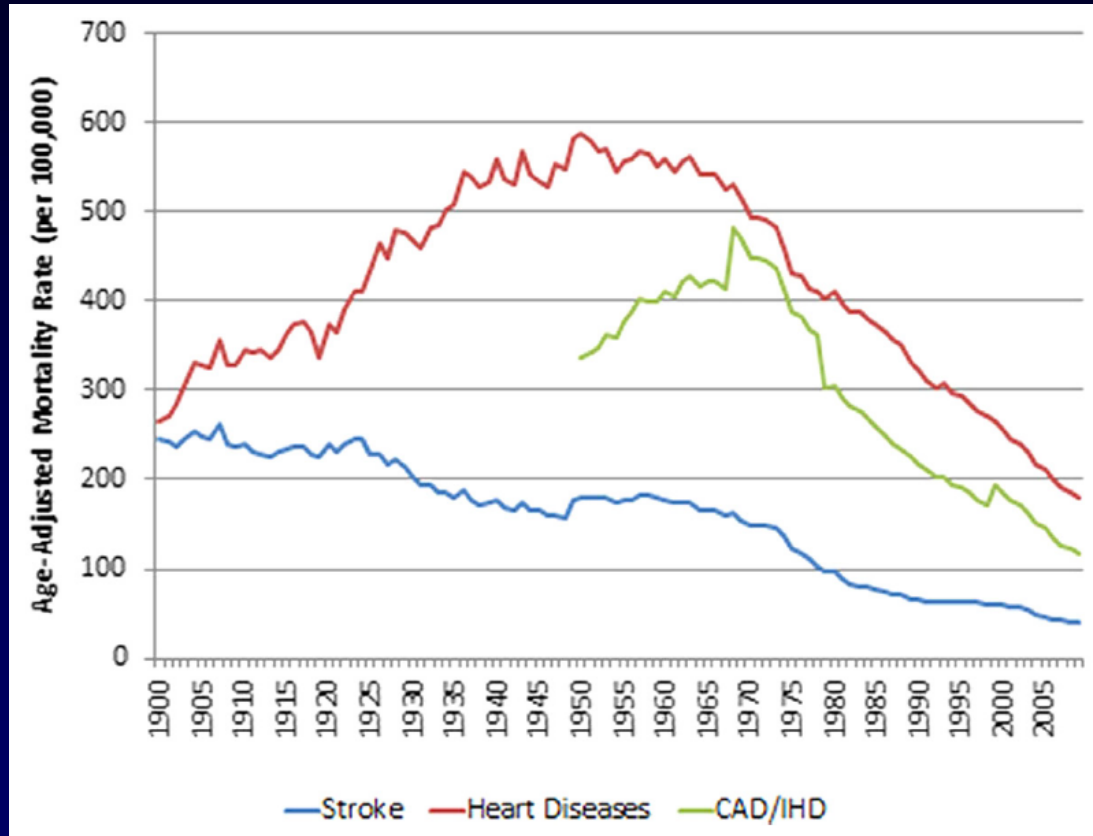
Early case-fatality rates in high-income countries



During the last decades
there was a *non-
significant reduction* in
early stroke case-fatality

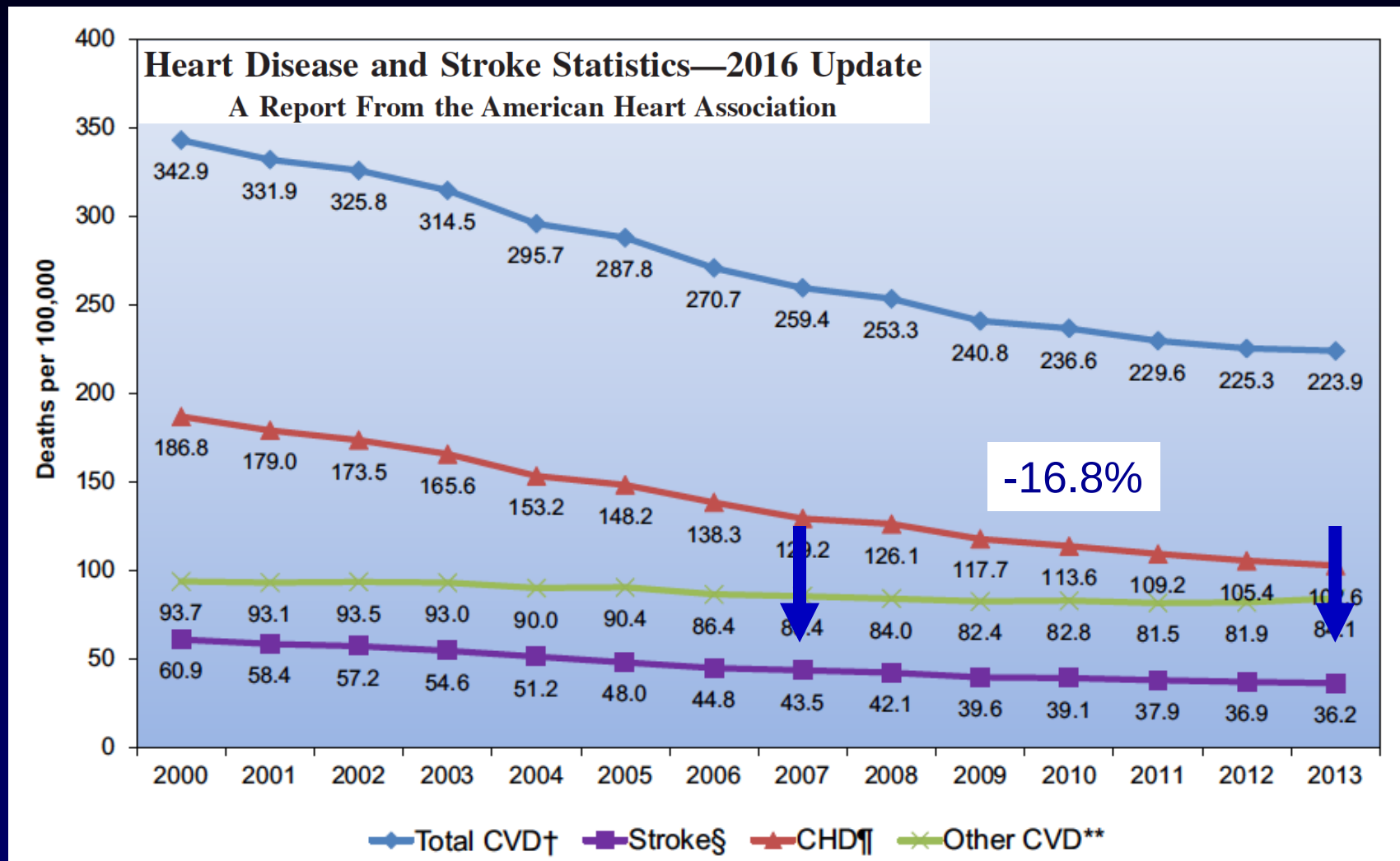
The yearly averaged %
change in stroke case-
fatality was -1.1% likely
reflecting advances in
stroke care and
secondary prevention

Decline in stroke mortality rates



The decline in mortality results from *reduced incidence of stroke and lower case-fatality rates* and is concurrent with cardiovascular risk factor control interventions

US age-standardized death rates attributable to cardiovascular disease 2000 to 2013



Circulation 2016; DOI: 10.1161/CIR.0000000000000350

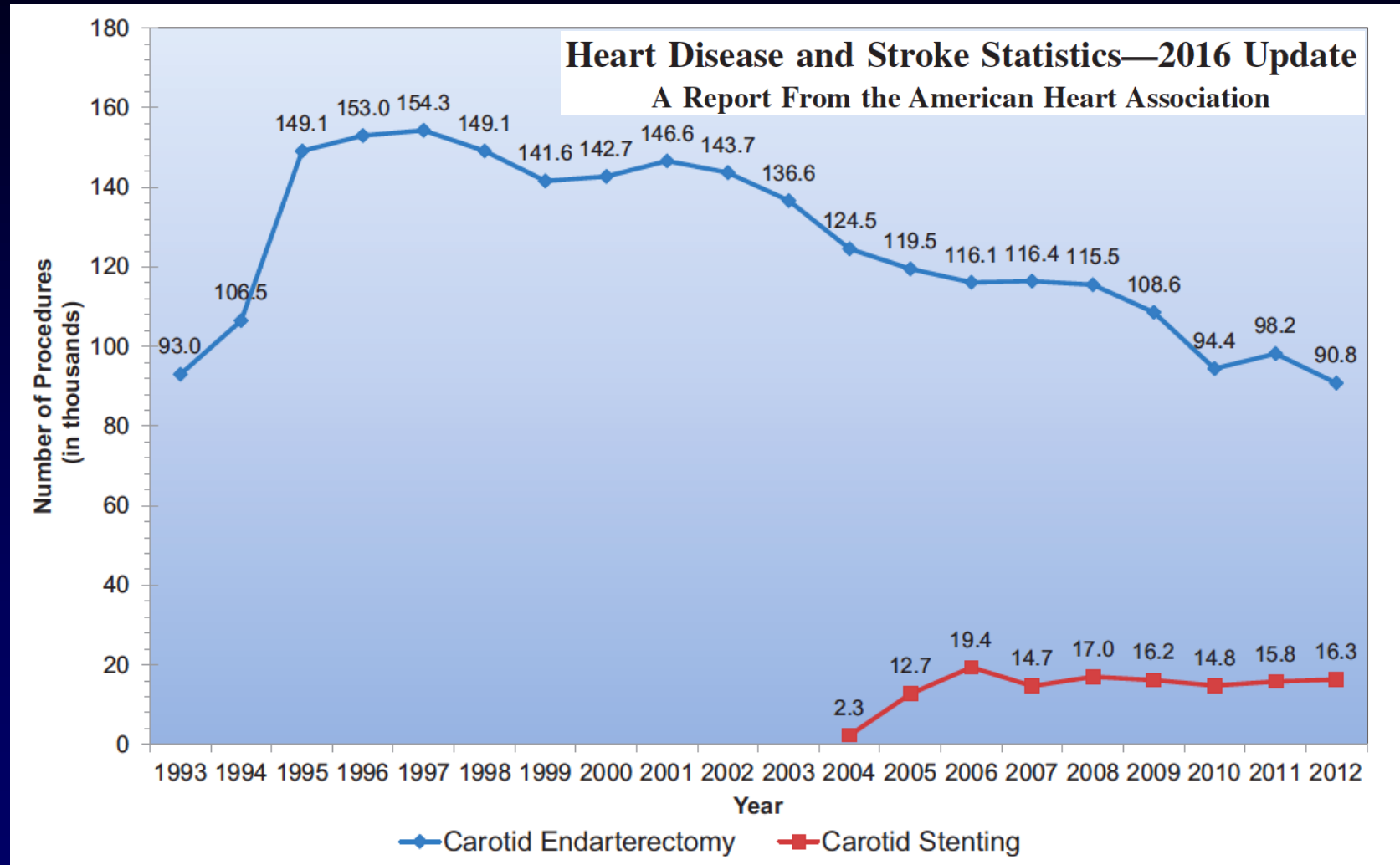
Changes in stroke death rates from 1981 to 2013

Slightly greater decline in age-adjusted stroke death rates in men (-61.4%) than in women (-58.9%) aged ≥ 18 years

Stroke death rates declined more among people aged ≥ 65 years (-54.1%) than those aged 45 to 64 years (-53.6%) or those aged 18 to 44 years (-45.9%)

Age-adjusted stroke death rates for adults aged ≥ 18 years declined by $\approx 50\%$ or more among all racial groups

Trends in carotid endarterectomy and stenting procedures

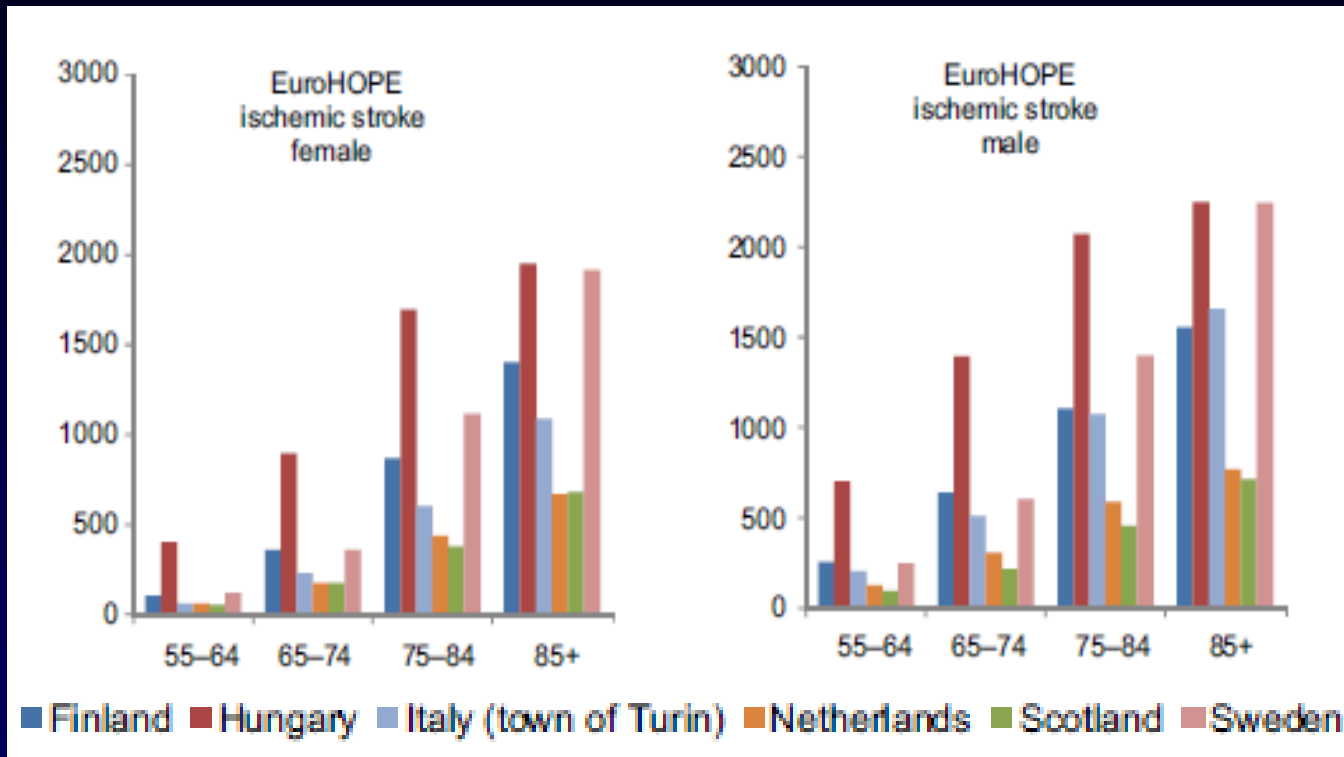


Epidemiology of Stroke in Europe

Large differences in incidence, prevalence and mortality have been reported between Eastern and Western Europe

This has been attributed to differences in risk factors distribution, with higher levels of hypertension and other risk factors resulting in more severe strokes in Eastern Europe

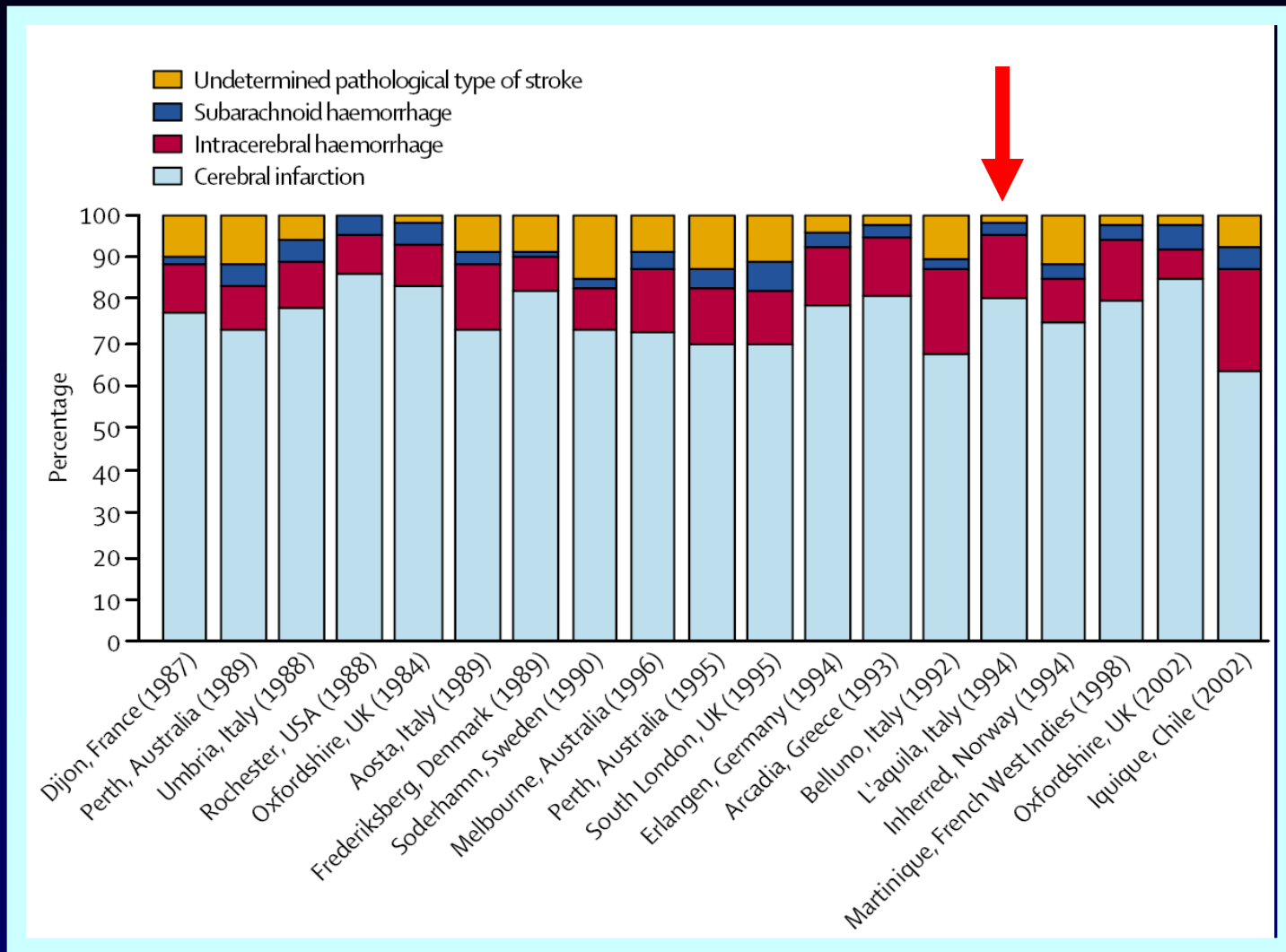
The EuroHOPE register study



Patients with an index stroke on admission in 2007 were followed for 1 year
The number of patients registered per 100,000 European standard population ranged from 77 in Scotland to 407 in Hungary
Large differences were observed in medication use

Eur J Neurol 2015;22:284-291

Proportional frequency of stroke types



Lancet 2005;365:2160-2161

Epidemiology of stroke in Italy

Table 1 Main characteristics of the population-based registers included in the analysis of stroke incidence and case-fatality

Study	Study period	Duration (years)	Population at risk (person-years)	Total strokes (n; % men)	Brain neuro-imaging (%)	Hospitalization (%)	Mean age at onset (years $\pm$ SD)		
							Men	Women	Total
Acquaviva-Casamasima (16)	2001–2002	2	38 735	127; 61	94	95	72.5 (NR)	77.5 (NR)	74.5 (NR)
Aeolian Islands (14,20)	1999–2002	3	13 431	62; 42	82	82	71.5 ($\pm$ 10.3)	74.6 ($\pm$ 9.6)	72.5 ($\pm$ 9.92)
Aosta (11,12)	1997	1	1 18 723	343; 47	97	95	69.3 (NR)	77.2 (NR)	73.3 (NR)
Belluno (15)	1992–1993	1	2 11 389	474; 43	90*	93	NR	NR	NR
L'Aquila (10,17–19, 25–28)	1994–1998	5	2 97 645	4353; 47	88	94	72.6 ($\pm$ 11.9)	76.7 ($\pm$ 10.6)	74.8 ($\pm$ 11.4)
Trasimeno (21–24)	1986–1989	3	49 218	375; 49	69*	85	NR	NR	NR
Vibo Valentia (16)	1996	1	1 79 186	321; 51	96*	98	71.9 ($\pm$ 10.6)	74.2 ($\pm$ 11.7)	73.0 ($\pm$ 11.2)

*Only brain computed tomography.NR, not reported.

67-83% IS – 10-20% ICH – 2-4.0% SAH – 1-18% UNDET

Int J Stroke 2011;6:219–227

*

Epidemiology of stroke in Italy

Incidence

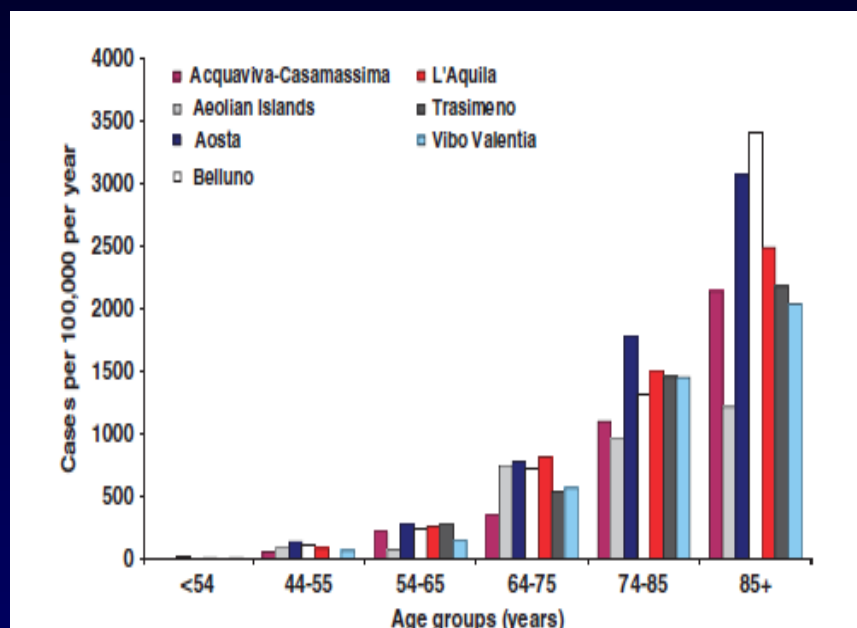


Table 4 Poisson's regression analysis of stroke incidence by age class, gender, and geographic area

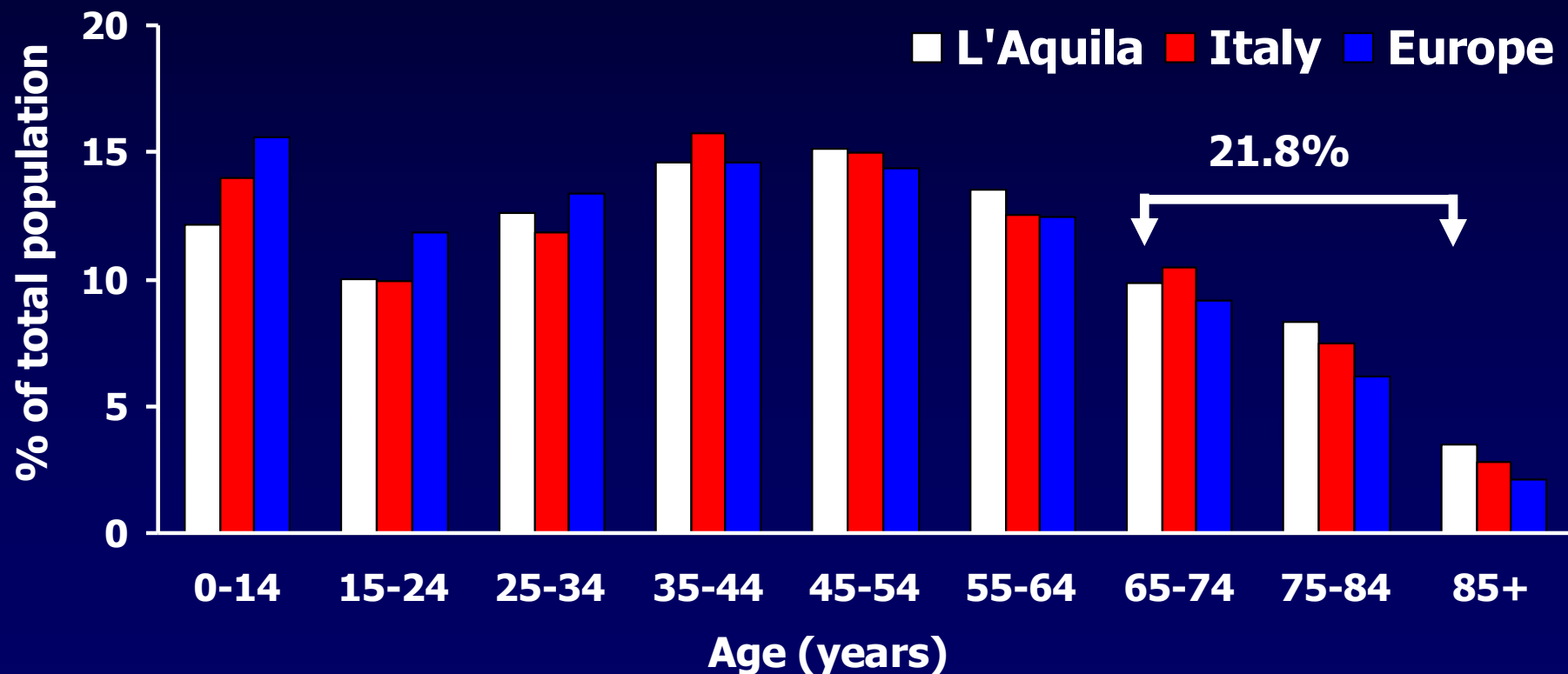
	IRR	95% CI	P
Area (reference Northern Italy)			
Central	0.96	0.89–1.03	0.23
Southern	0.72	0.64–0.80	<0.001
Age group (reference 0–54 years)			
55–64	10.5	9.3–11.9	<0.001
65–74	32.2	28.8–35.9	<0.001
75–84	63.6	57.0–70.9	<0.001
85+	109.8	97.6–123.4	<0.001
Gender (reference male gender)			
Female	0.78	0.74–0.82	<0.001

IRR, incidence rate ratios; CI, confidence interval.

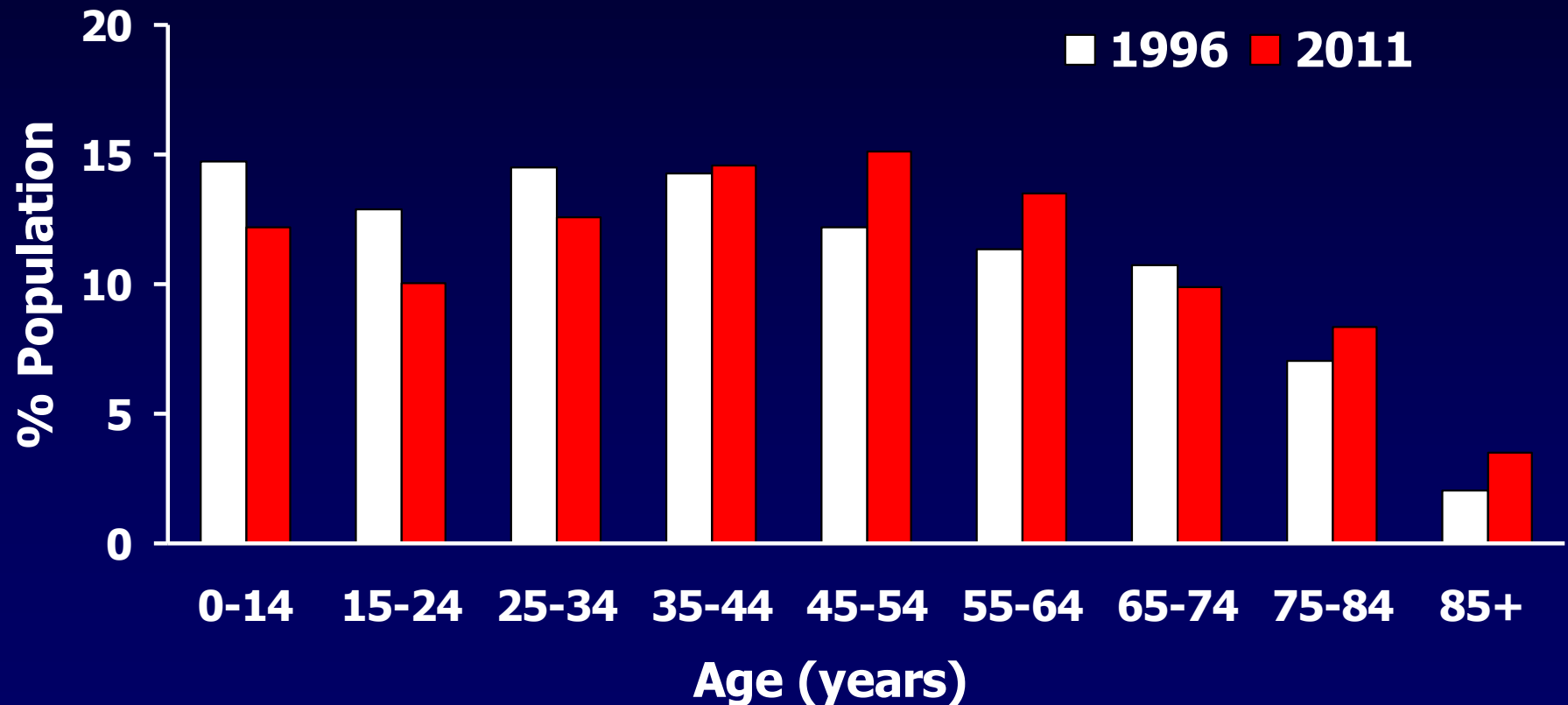
The incidence rates increased linearly with age, peaking in subjects aged 85+ years in all the registers

Age group, gender, and geographic area were significant predictors of stroke incidence

Comparison of the Age Structure of the Study Population with that of Italy (ISTAT, 2011) and Europe (EUROSTAT, 2011)

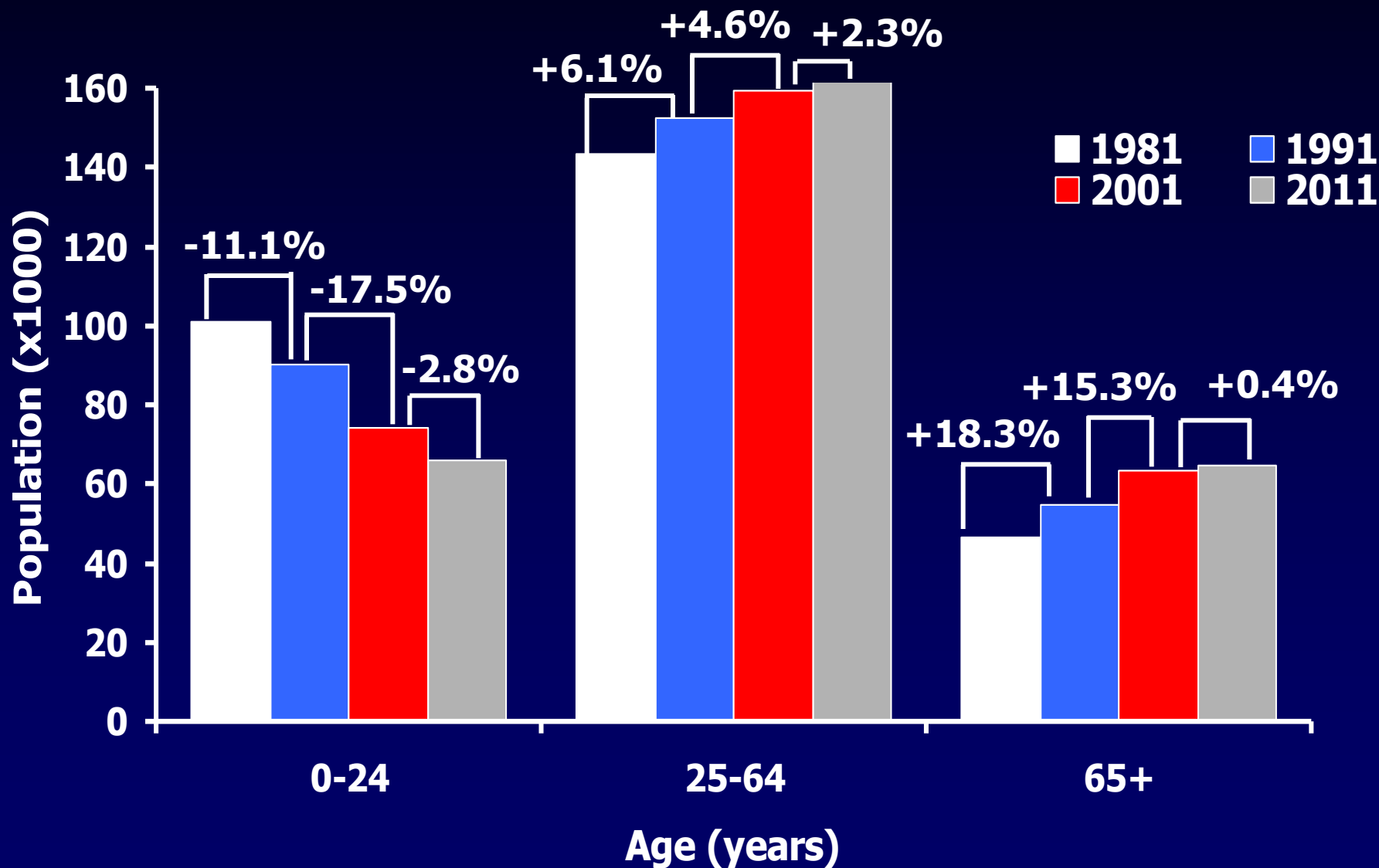


Comparison of the Age Structure of the Study Population between 1994-1998 and 2011



Age-structure Changes in Residents

ISTAT L'Aquila 1981-1991-2001-2011



High Stroke Incidence in the Prospective Community-Based L'Aquila Registry (1994–1998)

First Year's Results

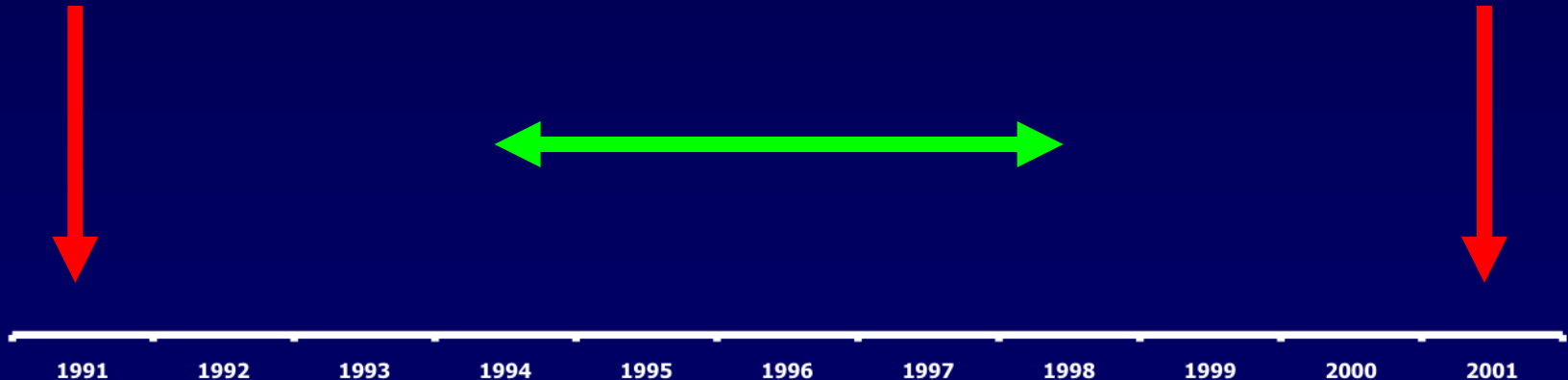
Antonio Carolei, MD; Carmine Marini, MD; Mario Di Napoli, MD;
Giacinto Di Gianfilippo, MD; Paola Santalucia, MD; Massimo Baldassarre, MD;
Giorgio De Matteis, MD; Ferdinando di Orio, MD

Stroke 1997;28:2500-2506

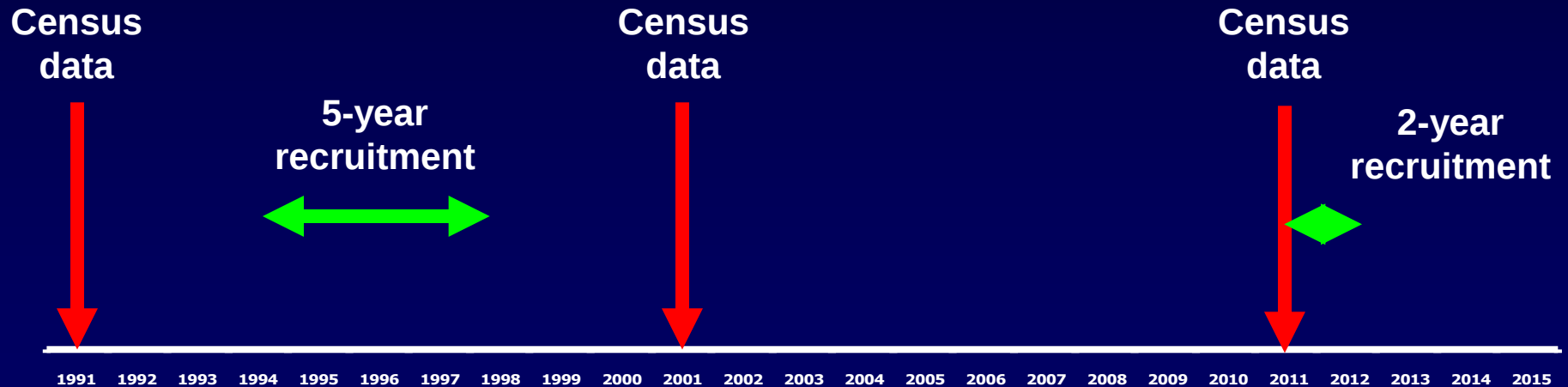
Census
data

5-year recruitment

Census
data



Study period



Demographic characteristics

1994-1998

Gender	n	Age (years)		
		mean $\pm$ SD	min	max
Men	2051	72.7 $\pm$ 11.8	5	100
Women	2302	76.7 $\pm$ 10.6	16	106
Both	4353	74.8 $\pm$ 11.4	5	106

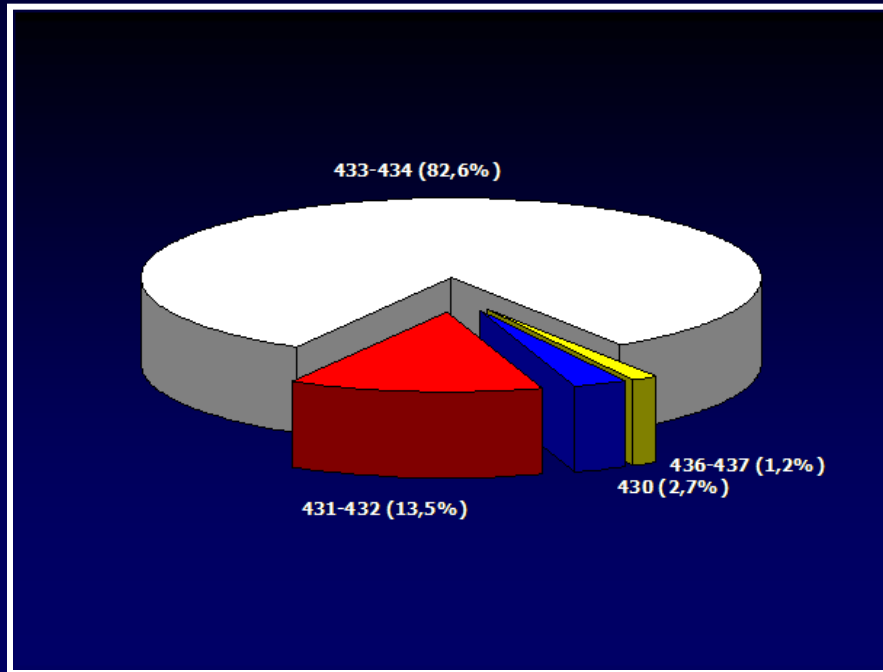
2011-2012

Gender	n	Age (years)		
		mean $\pm$ SD	min	max
Men	417	72.7 $\pm$ 13.2	7	96
Women	441	78.2 $\pm$ 12.6	19	103
Both	858	75.5 $\pm$ 13.2	7	103

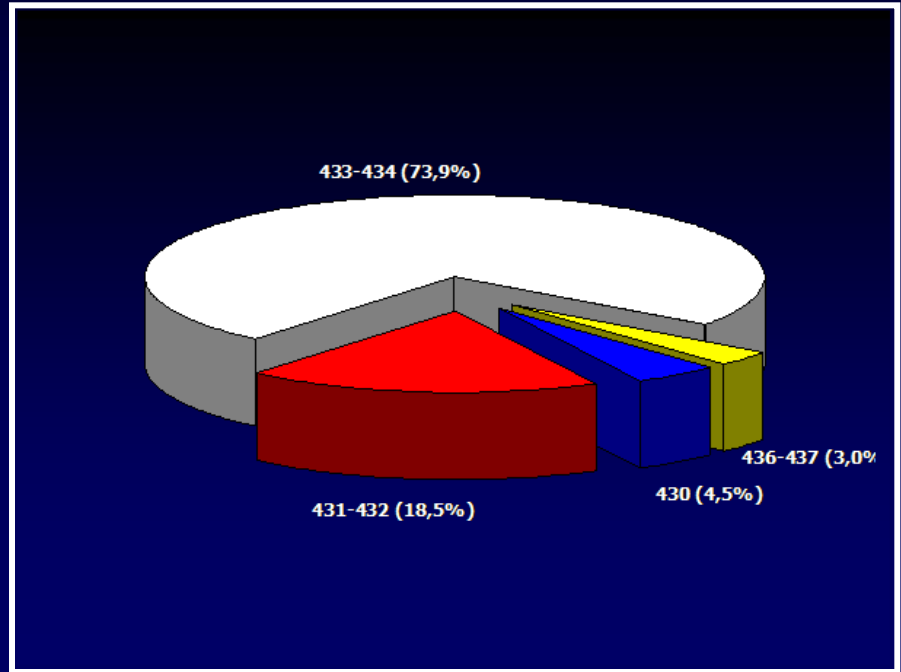
Distribution of Cerebrovascular Events

(ICD - IX Revision)

1994-1998



2011-2012

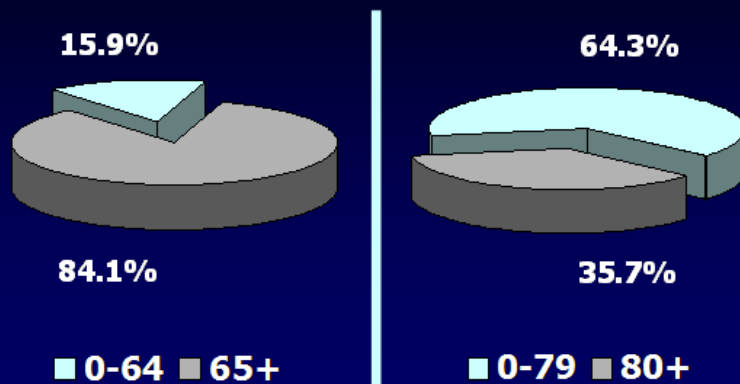


*430: subarachnoid hemorrhage; 431-432: intracerebral hemorrhage;
433-434: cerebral ischemia; 436-437: ill-defined cerebrovascular disease*

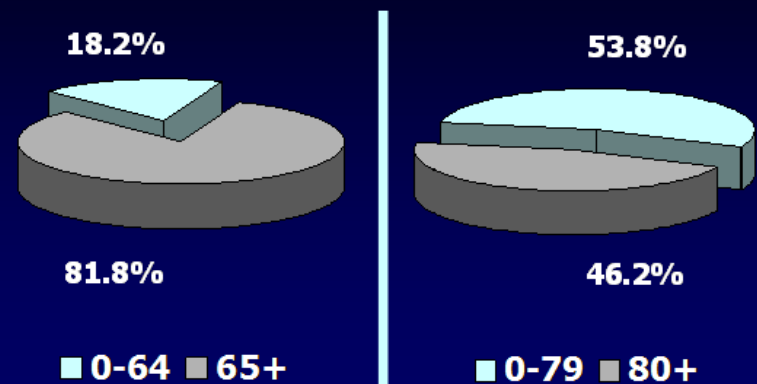
First-ever Stroke

Age distribution

1994-1998

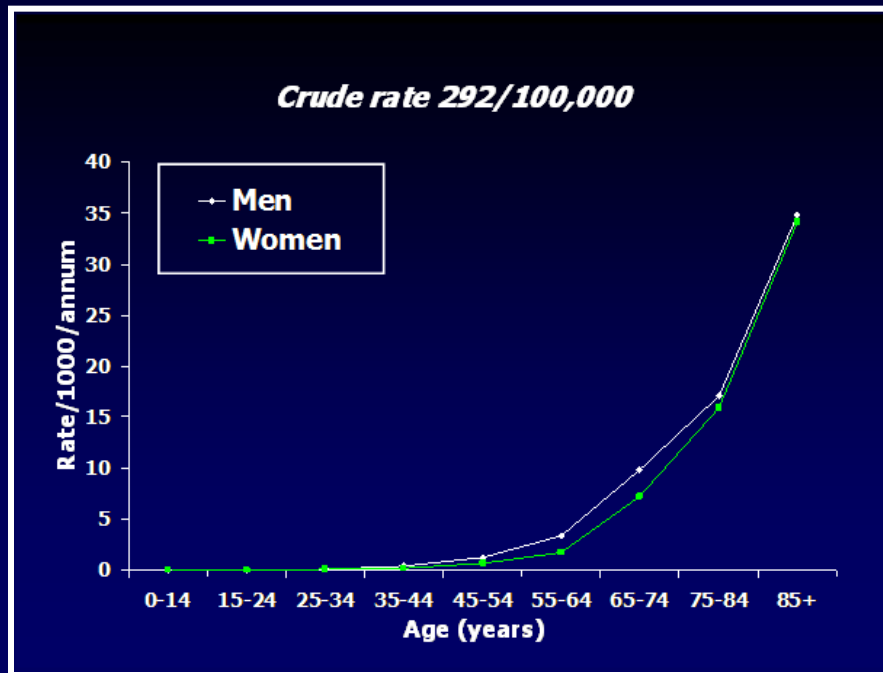


2011-2012

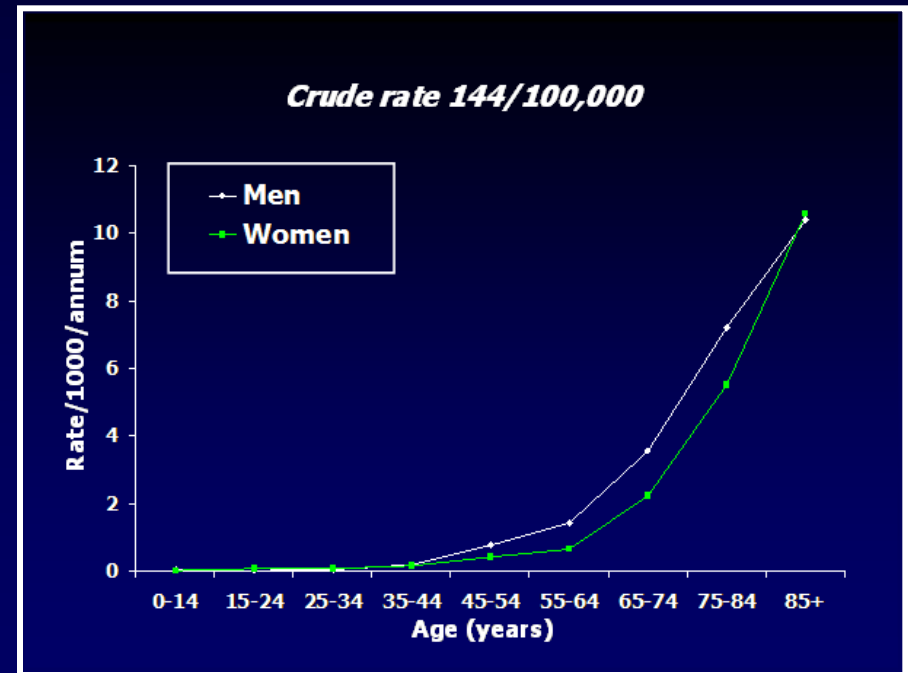


First-ever Stroke Incidence

1994-1998



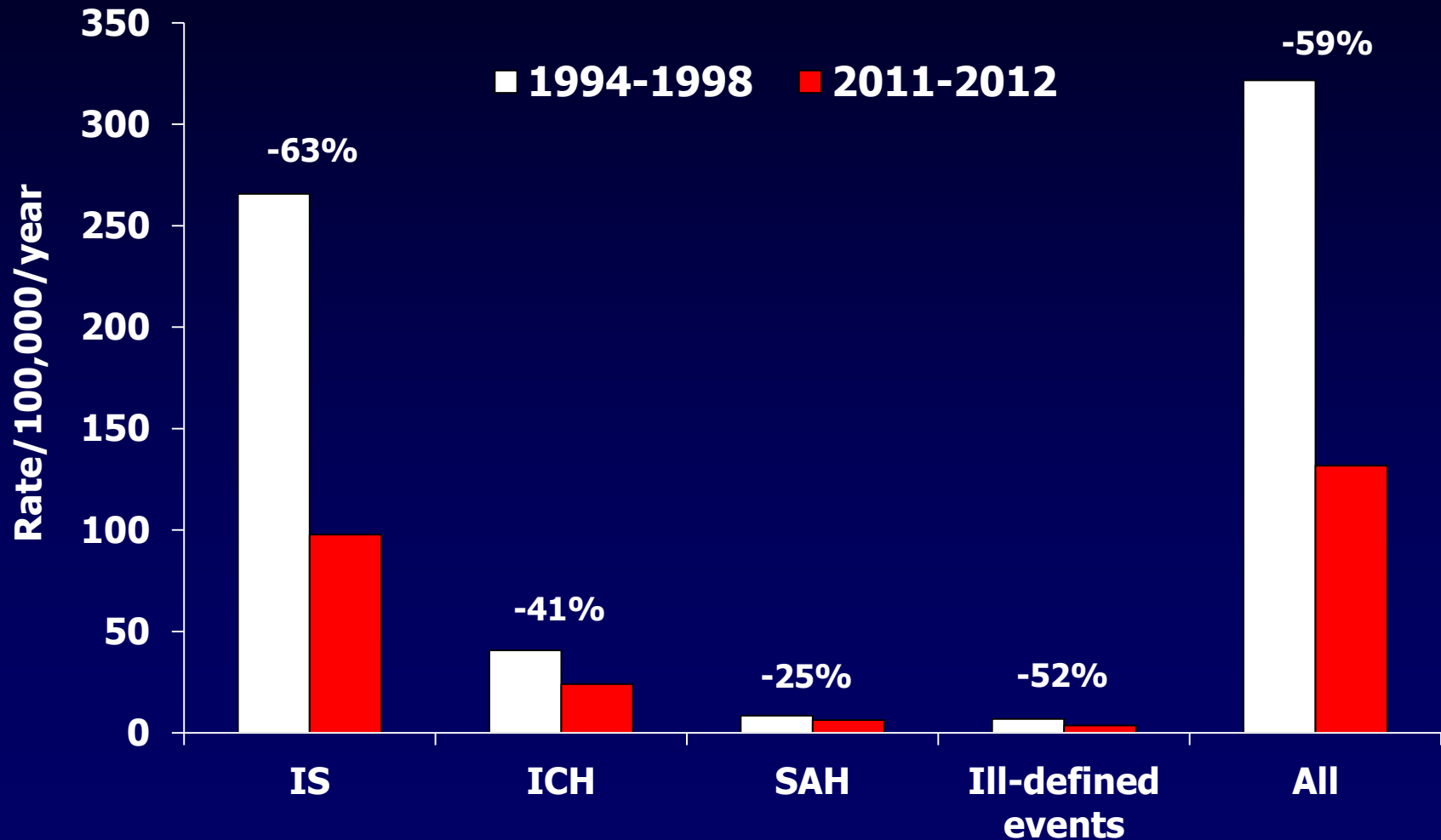
2011-2012



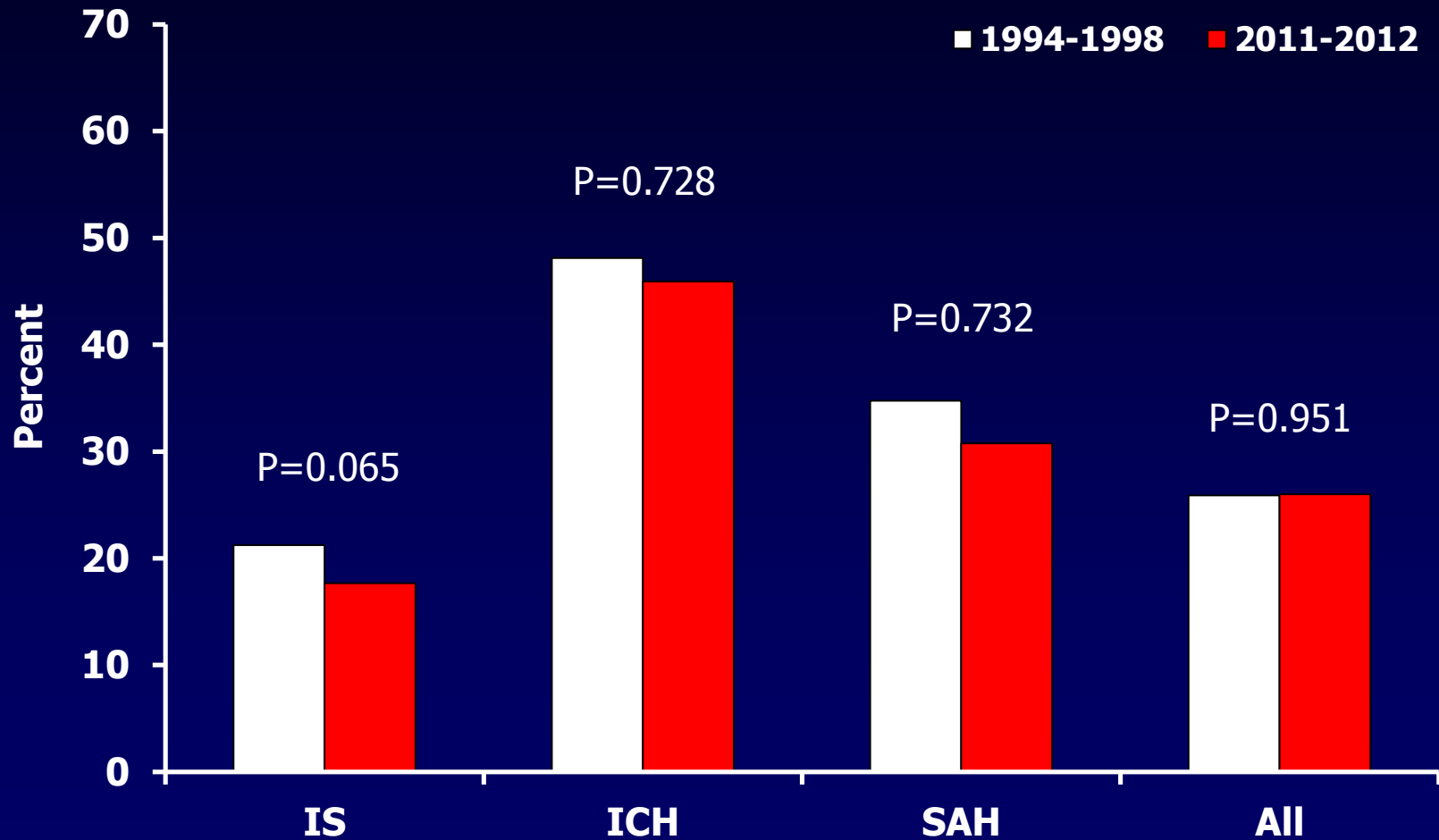
The decreased stroke incidence over the last two decades suggested that the improvement of prevention strategies might have contributed not only to postpone the age of stroke onset but also to reduce stroke incidence and mortality

Incidence of Cerebrovascular Events

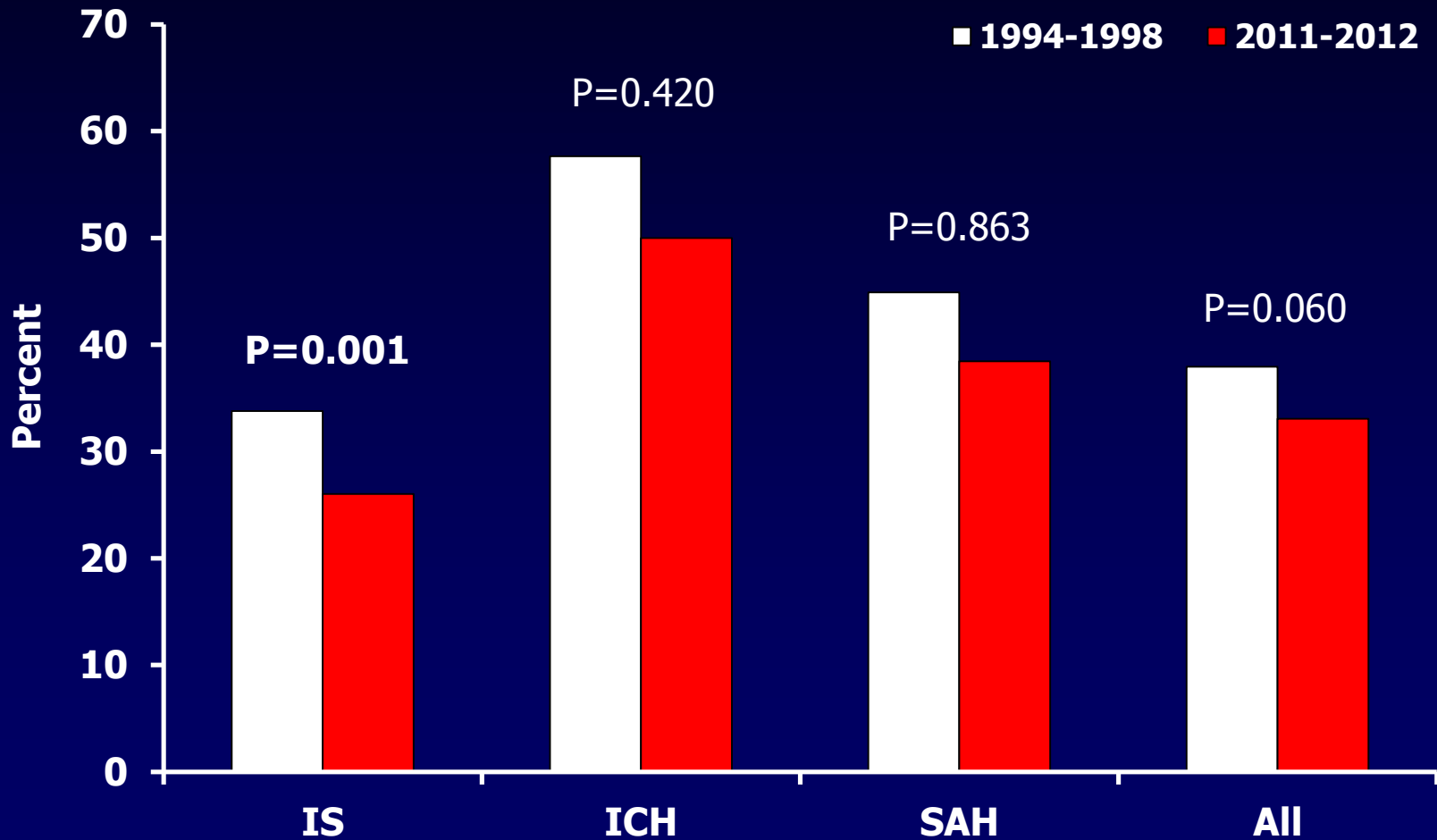
(ICD - IX Revision)



30-day Case-fatality rates



1-year Case-fatality rates



Risk factors

	1994-1998	2011-2012
Arterial hypertension	65.3	72.4 
Diabetes mellitus	25.5	22.4
Coronary heart disease	24.6	14.3 
Hypercholesterolemia	24.4	18.5 
Smoking habit	23.5	13.3 
Atrial fibrillation	21.7	27.5 
Peripheral arterial disease	11.7	5.1 
Previous TIA	7.4	5.4

Demographics of Ischemic Stroke

1994-1998

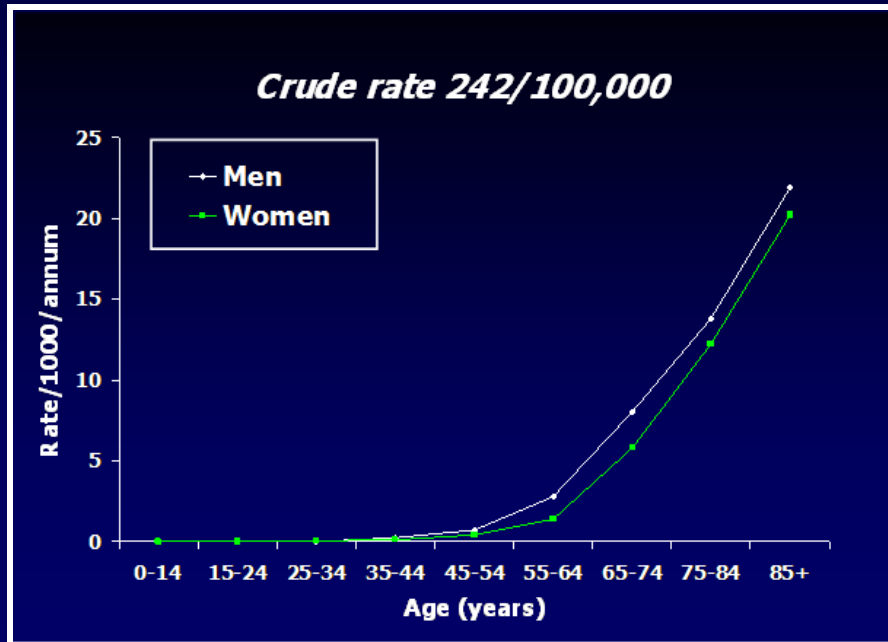
Gender	n	Age (years)		
		mean±SD	min	max
Men	1700	73.4±11.0	5	100
Women	1894	77.0±10.1	16	100
Both	3594	75.3±10.7	5	100

2011-2012

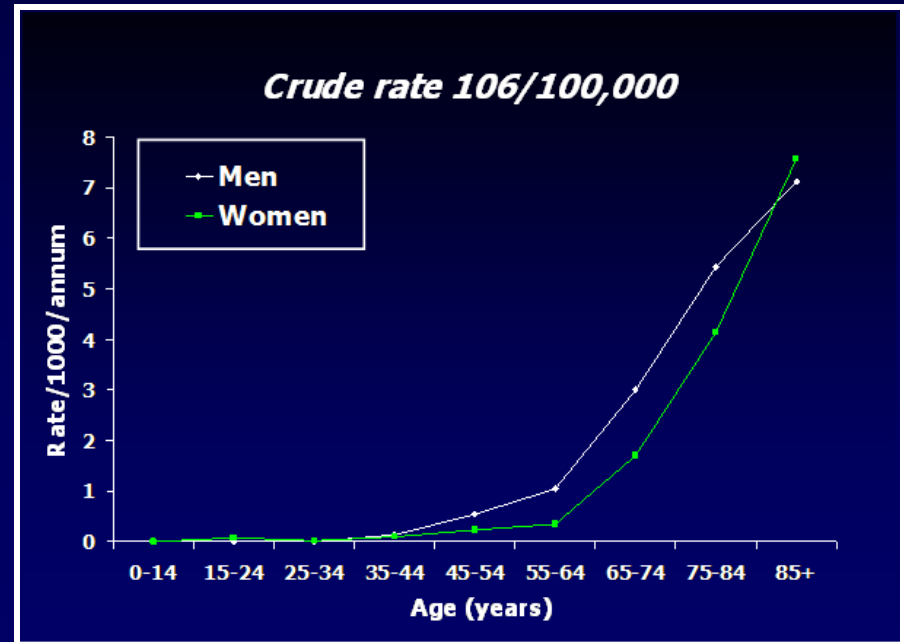
Gender	n	Age (years)		
		mean±SD	min	max
Men	316	72.5±12.9	7	96
Women	318	78.6±12.0	19	96
Both	634	75.6±12.8	7	96

Ischemic Stroke Incidence

1994-1998



2011-2012



Ischemic Stroke Incidence Trend

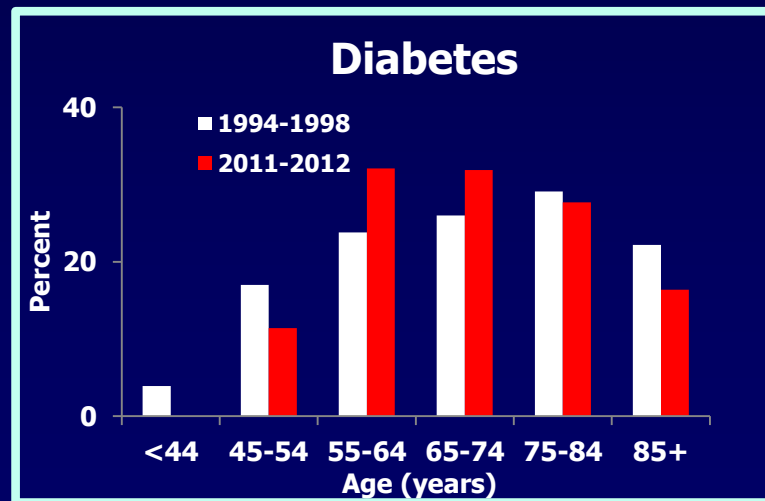
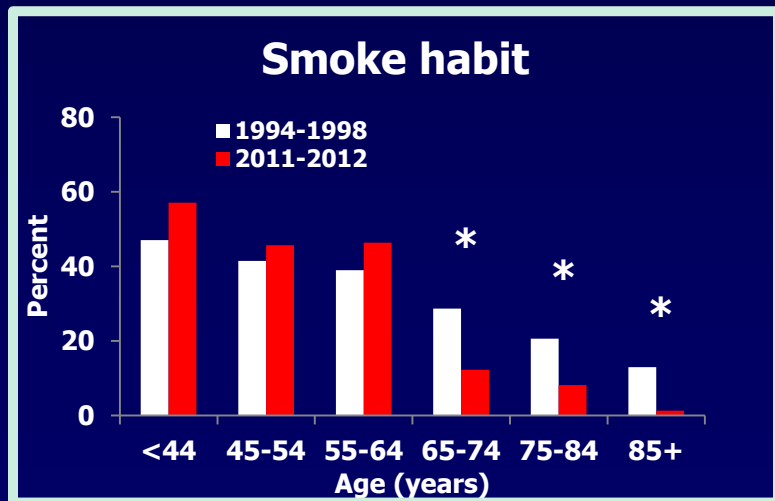
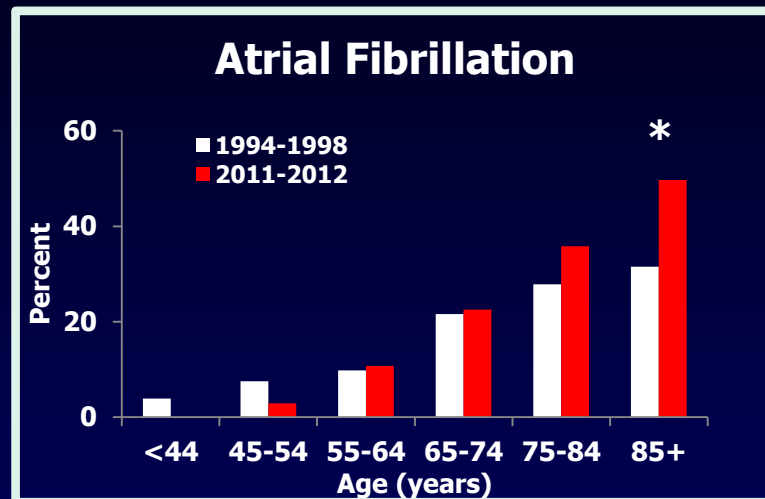
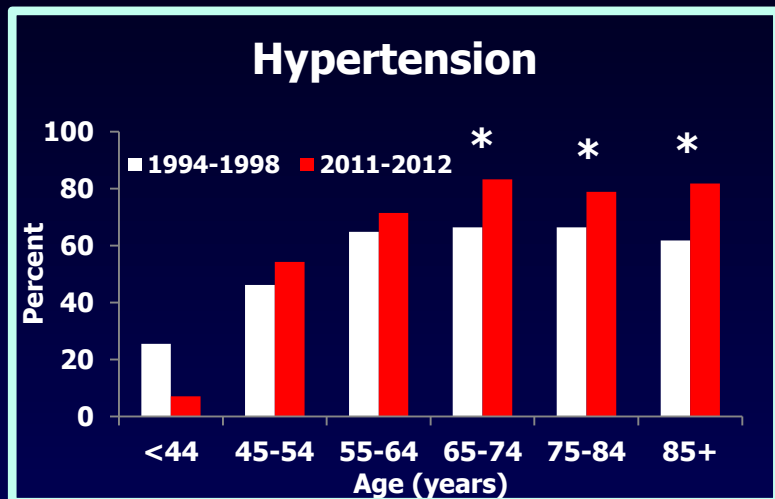
	Crude rate x1000 (95% CI)		Incidence rate ratio	(95% CI)	P Value
	1994-1998	2011-2012			
All	2.42 (2.39-2.44)	1.06 (0.98-1.15)	0.44	0.40-0.48	<0.001
Men	2.36 (2.32-2.39)	1.09 (0.97-1.21)	0.46	0.41-0.52	<0.001
Women	2.47 (2.44-2.50)	1.04 (0.93-1.16)	0.42	0.37-0.47	<0.001
Age <55 years	0.16 (0.13-0.18)	0.13 (0.09-0.17)	0.82	0.59-1.12	0.216
Age 55-74 years	4.37 (4.15-4.60)	1.39 (1.20-1.60)	0.32	0.27-0.37	<0.001
Age ≥75 years	14.68 (14.04-15.34)	5.51 (4.97-6.08)	0.38	0.34-0.42	<0.001

Risk factors for Ischemic Stroke

	1994-1998	2011-2012
Arterial hypertension	64.2	77.0 
Diabetes mellitus	25.7	24.3
Coronary heart disease	26.2	15.9 
Hypercholesterolemia	26.1	20.3
Smoking habit	24.1	13.9 
Atrial fibrillation	24.2	31.5 
Peripheral arterial disease	12.2	6.2
Previous TIA	8.3	5.7

Risk Factors for Ischemic Stroke

1994-1998 vs 2011-2012



***P<0,001**

Demographics of ICH

1994-1998

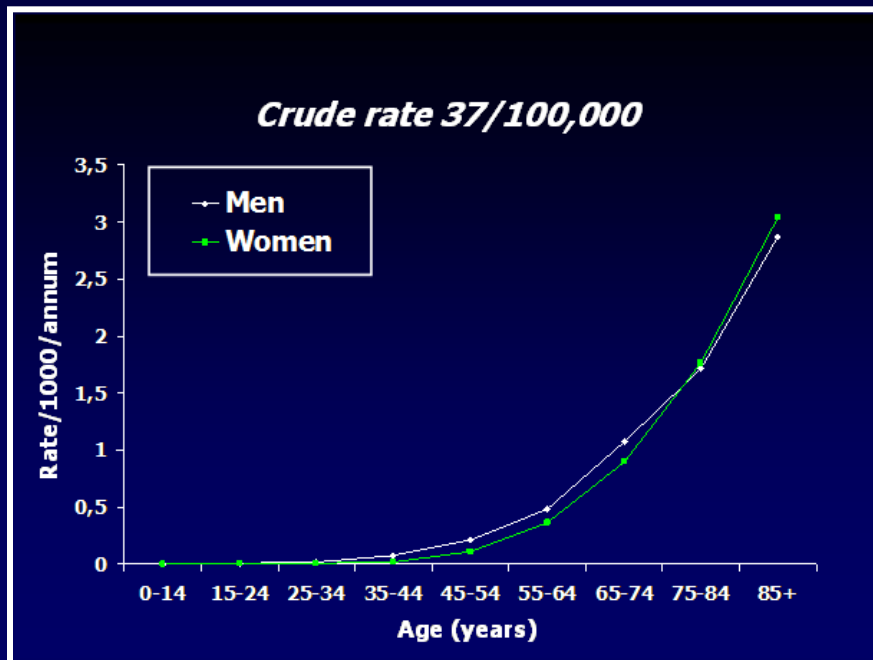
Gender	n	Age (years)		
		mean $\pm$ SD	min	max
Men	247	70.5 $\pm$ 13.1	24	95
Women	302	76.1 $\pm$ 11.5	19	106
Both	549	73.6 $\pm$ 12.5	19	106

2011-2012

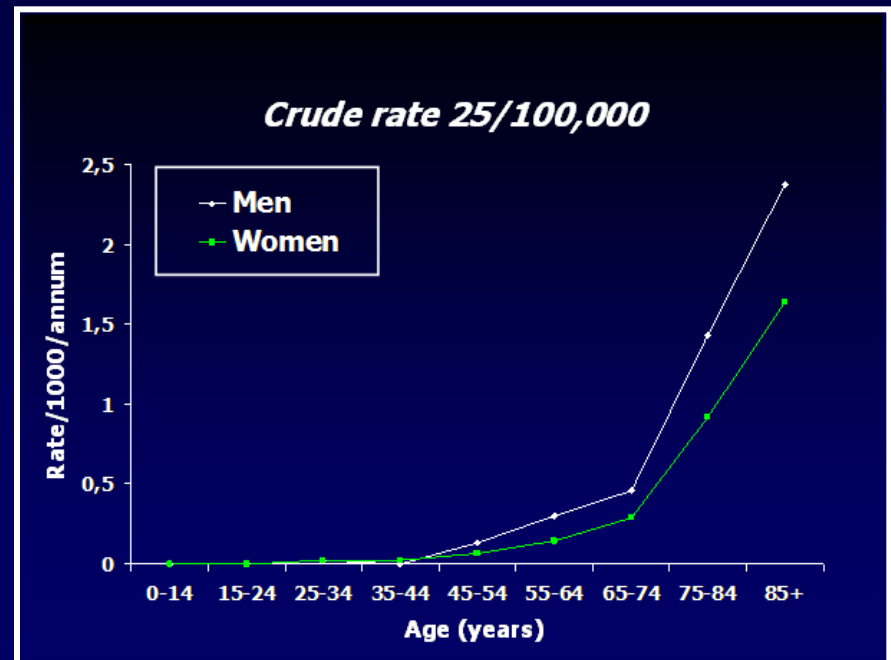
Gender	n	Age (years)		
		mean $\pm$ SD	min	max
Men	77	73.9 $\pm$ 13.0	27	92
Women	71	77.8 $\pm$ 13.1	25	98
Both	148	75.8 $\pm$ 13.2	25	98

ICH Incidence

1994-1998



2011-2012



ICH Incidence Trend

	Crude rate x1000 (95% CI)		Incidence rate ratio	95% CI	P Value
	1994/1998	2011/2012			
All	0.37 (0.36-0.38)	0.25 (0.21-0.29)	0.67	0.56-0.80	<0.001
Men	0.34 (0.31-0.38)	0.27 (0.21-0.33)	0.77	0.60-0.99	0.049
Women	0.39 (0.35-0.44)	0.23 (0.18-0.29)	0.59	0.45-0.76	<0.001
Age <55 years	0.04 (0.03-0.05)	0.03 (0.02-0.05)	0.72	0.36-1.32	0.319
Age 55-74 years	0.69 (0.60-0.79)	0.29 (0.20-0.39)	0.41	0.29-0.57	<0.001
Age ≥75 years	2.04 (1.80-2.29)	1.35 (1.10-1.65)	0.66	0.52-0.83	0.0005

Risk factors for ICH

	1994-1998	2011-2012
Arterial hypertension	75.6	68.9
Diabetes mellitus	26.2	21.6
Coronary heart disease	17.9	10.8 ↓
Hypercholesterolemia	17.5	15.5
Smoking habit	20.6	11.5 ↓
Atrial fibrillation	10.7	20.3* ↑
Peripheral arterial disease	9.8	3.4 ↓
Previous TIA	3.6	5.4

*including patients with AF and medication-related ICH

Demographics of SAH

1994-1998

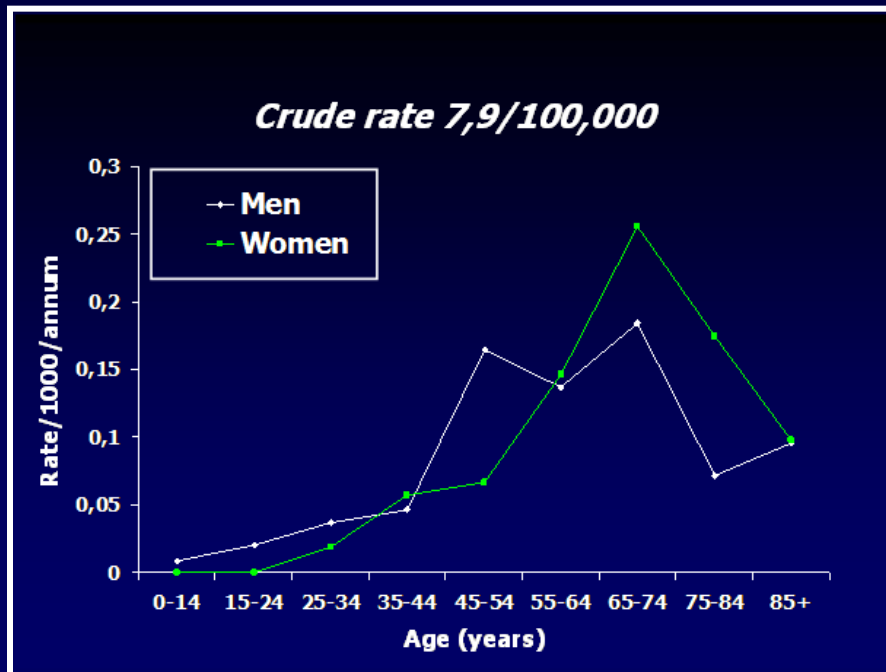
Gender	n	Age (years)		
		mean $\pm$ SD	min	max
Men	55	56.2 $\pm$ 16.8	15	92
Women	63	64.7 $\pm$ 14.1	28	101
Both	118	60.7 $\pm$ 15.9	15	101

2011-2012

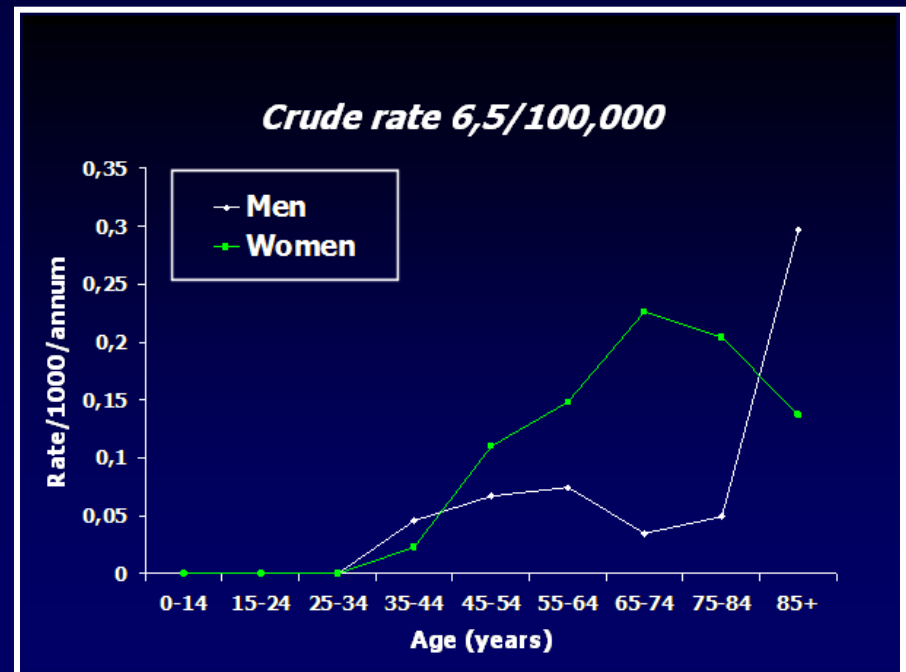
Gender	n	Age (years)		
		mean $\pm$ SD	min	max
Men	12	61.9 $\pm$ 17.6	36	91
Women	27	65.4 $\pm$ 13.1	42	89
Both	39	64.4 $\pm$ 14.5	36	91

SAH Incidence

1994-1998



2011-2012



Atrial fibrillation profile

1994-1998

4353 First-ever strokes
946 (22%) with AF

3594 Ischemic strokes
869 (24%) with AF

1316 Ischemic strokes over 80
397 (30%) with AF

2011-2012

858 First-ever strokes
235 (27%) with AF

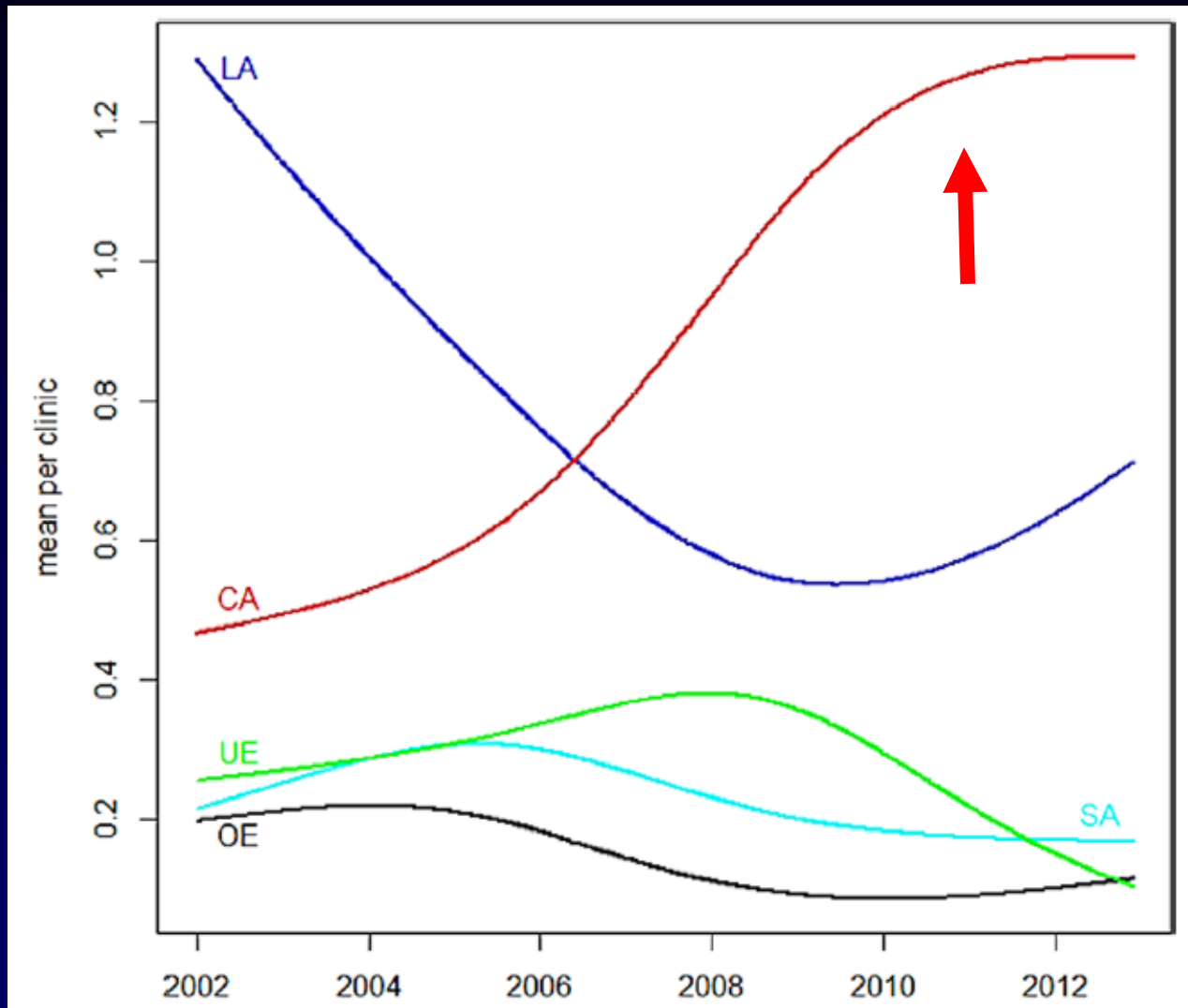
634 Ischemic strokes
199 (31%) with AF

289 Ischemic strokes over 80
126 (44%) with AF

Incidence of ischemic stroke subtypes in Europe

	Ischemic stroke large vessels	Ischemic stroke small vessels	Ischemic stroke cardioembolic 	Ischemic stroke miscellaneous	Unknown ischemic stroke	Total
Total	15.3 (95% CI: 12–19.3)	25.8 (95% CI: 21.5–30.9)	30.2 (95% CI: 25.6–35.7)	2.1 (95% CI: 0.9–3.9)	39.3 (95% CI: 34–45.5)	112.7 (95% CI: 103.6–122.6)
Men	23.6 (95% CI: 17.1–31.6)	35.3 (95% CI: 27.2–45.2)	29.1 (95% CI: 21.7–38.2)	1.4 (95% CI: 0.3–4.1)	40.2 (95% CI: 31.3–50.6)	129.7 (95% CI: 114.3–147)
Women	9.2 (95% CI: 6.1–13.4)	19.8 (95% CI: 15–25.8)	30.8 (95% CI: 24.8–37.8)	2.5 (95% CI: 0.9–5.5)	39.1 (95% CI: 32.5–47)	101.4 (95% CI: 90.5–113.7)

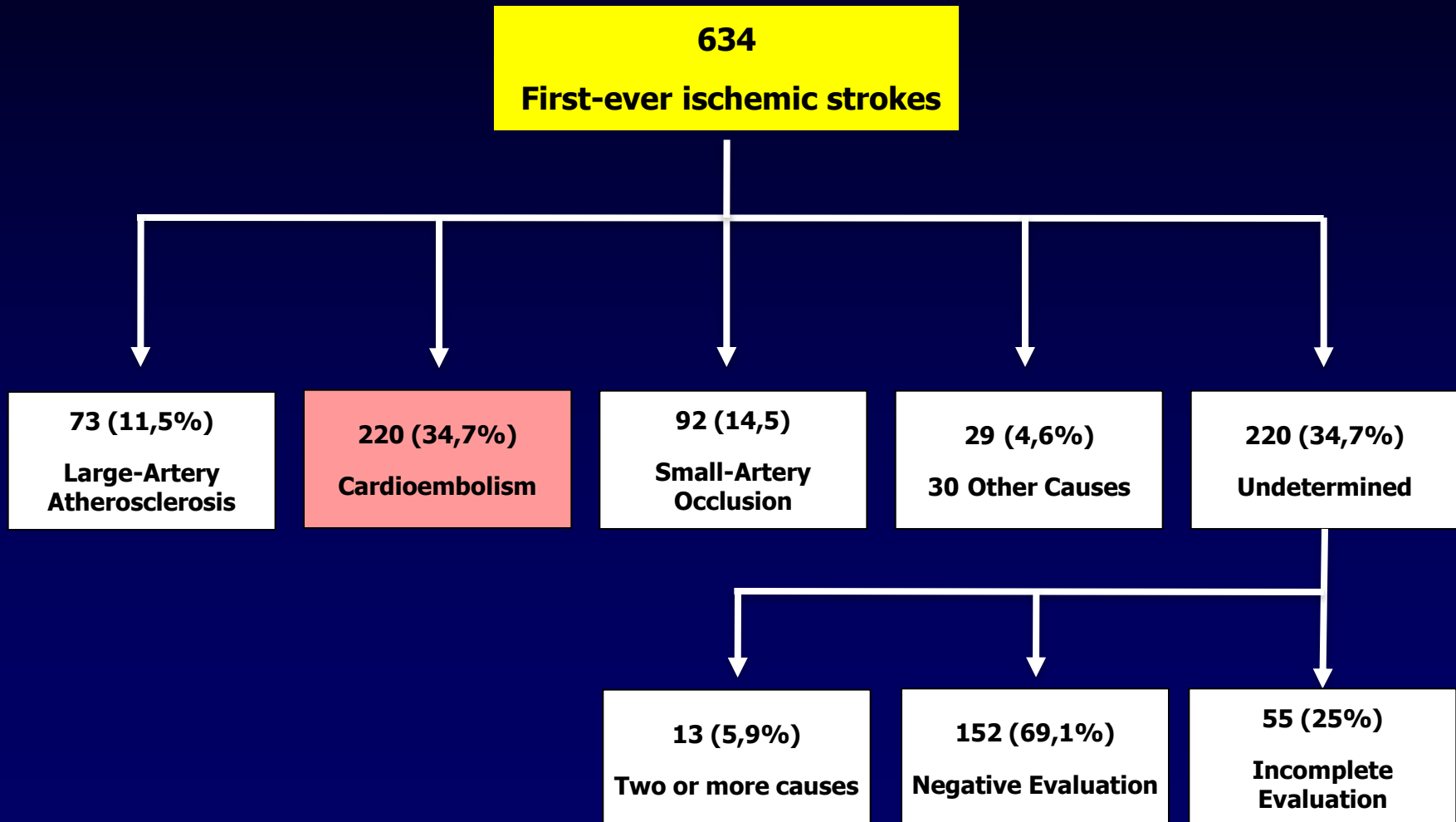
Secular trends in ischemic stroke subtypes



LA: large artery
CA: cardioembolic
SA: small artery
OE: other etiology
UE: undetermined

L' Aquila Stroke Registry

2011-2012



L'Aquila Stroke Registry

2011-2012

Main characteristics of the included patients according to TOAST criteria

	LAA	TOAST CE	CE	OC	UND	P
Main characteristics			220 (34.7) 78.91±12.3			
n. %	73 (11.5)	220 (34.7)		9 (4.6)	220 (34.7)	
Age ±DS	76.33±10.9	78.91±12.3		76.97±19.0	76.14±11.4	<0.001
Gender			91 (41.3) 129 (58.6)			
Men	42 (57.5)	91 (41.3)		3 (62.0)	108 (49.0)	
Women	31 (42.2)	129 (58.6)		1 (37.9)	112 (50.9)	0.004
Stroke severity and disability						
NIHSS at onset (median, IQR)	6 (3-12)	10 (4-17,5)		(2-11)	6 (3-12)	<0.001
mRS at discharge (median, IQR)	3 (2-5)	4 (3-5)	10 (4-17,5) 4 (3-5)	5 (1-5)	3 (2-4)	<0.001
Case fatality rates						
30-day mortality	13.7	26.8		17.2	16.3	<0.001
1-year mortality	20.5	38.2		24.1	24.1	<0.001

26.8
38.2

L'Aquila Stroke Registry

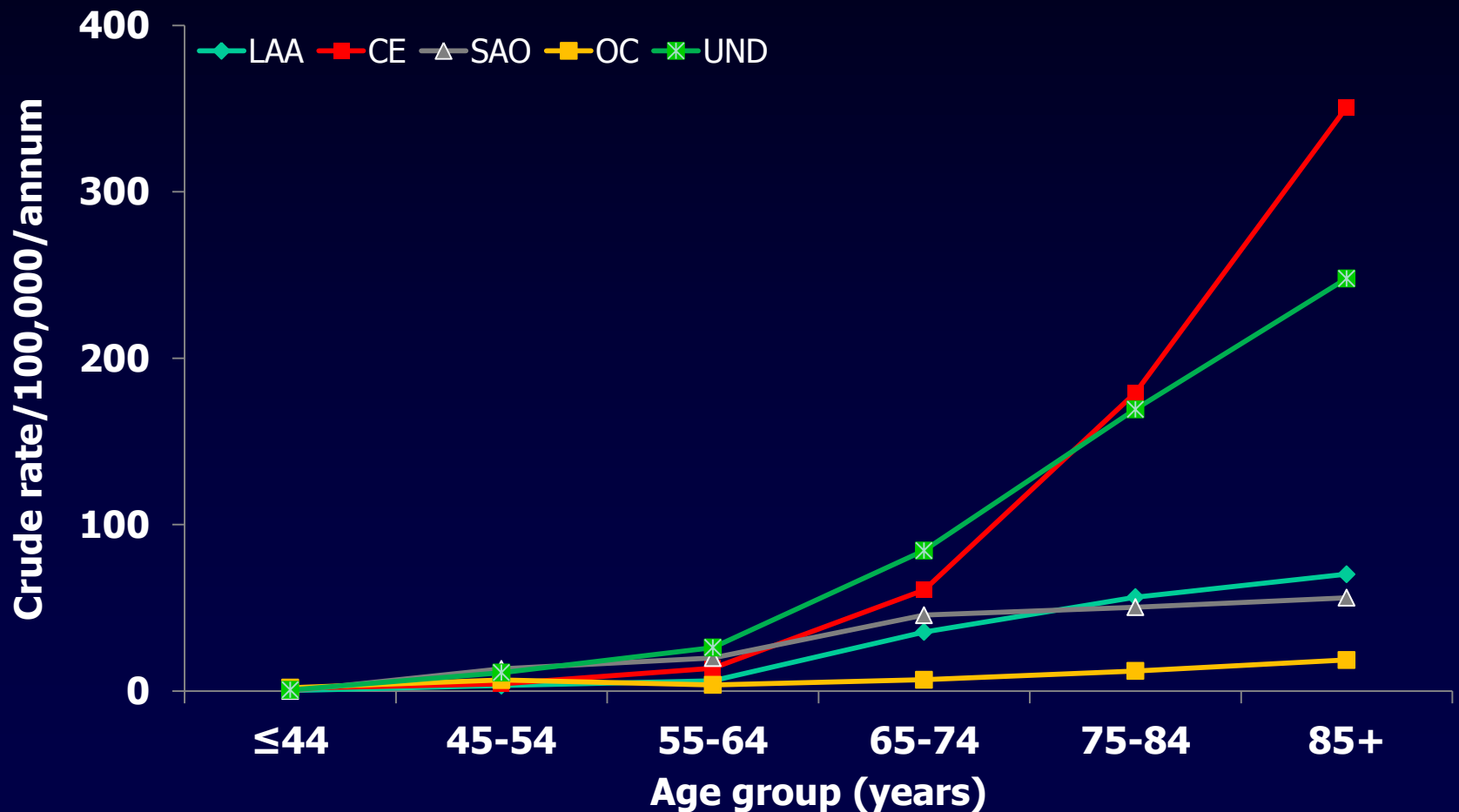
2011-2012

Risk factors distribution according to TOAST criteria

Risk factor	Total (634)		LAA (73)		CE (220)		SAO (92)		OC (29)		UND (220)		P
	N	%	N	%	N	%	N	%	N	%	N	%	
Hypertension	488	77.0	56	76.7	180	81.8	79	85.9	13	44.8	160	72.7	<0.001
Diabetes	154	24.3	23	31.5	55	25.0	27	29.3	8	27.6	41	18.6	0.154
Dyslipidemia	130	20.5	16	21.9	41	18.6	29	31.5	4	13.8	40	18.2	0.052
Atrial fibrillation	200	31.5	2	2.7	173	78.6	11	12.0	1	3.4	13	5.9	<0.001
Coronary heart disease	101	15.9	10	13.7	47	21.4	18	19.6	4	13.8	22	10.0	0.029
Peripheral artery disease	39	6.2	6	8.2	15	6.8	6	6.5	1	3.4	11	5.0	0.863
Cigarette smoking	88	13.9	16	21.9	19	8.6	16	17.4	9	31.0	28	12.7	0.074
Alcohol abuse	80	12.6	14	19.2	25	11.4	11	12.0	2	6.9	28	12.7	0.471

Crude incidence of ischemic stroke subtypes by age groups

2011-2012



Definitions of TIA

Time-based a sudden, focal neurological deficit of presumed vascular origin lasting less than 24 hours

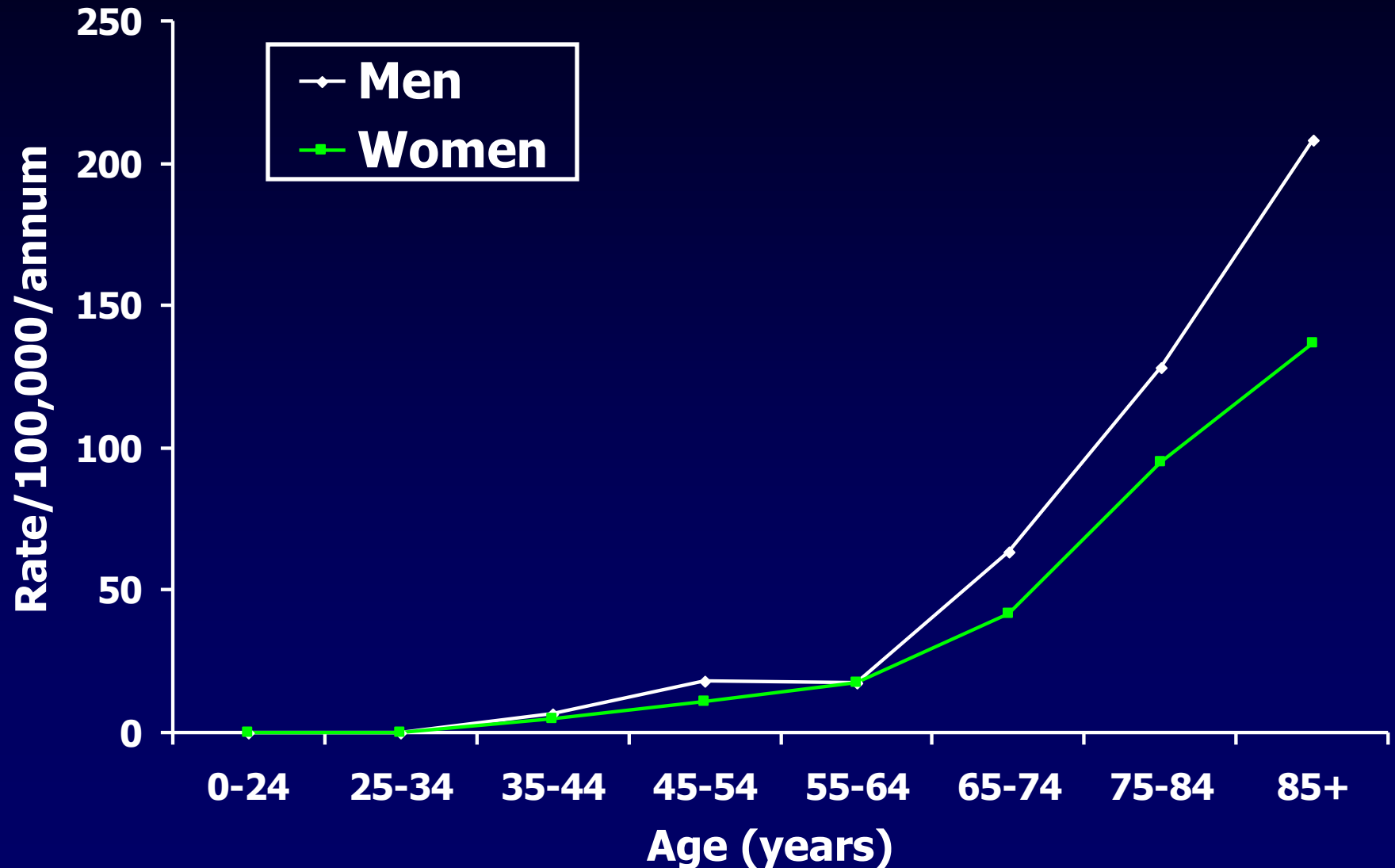
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Cerebral infarction with transient symptoms events that last <24 hours but are associated with cerebral infarction

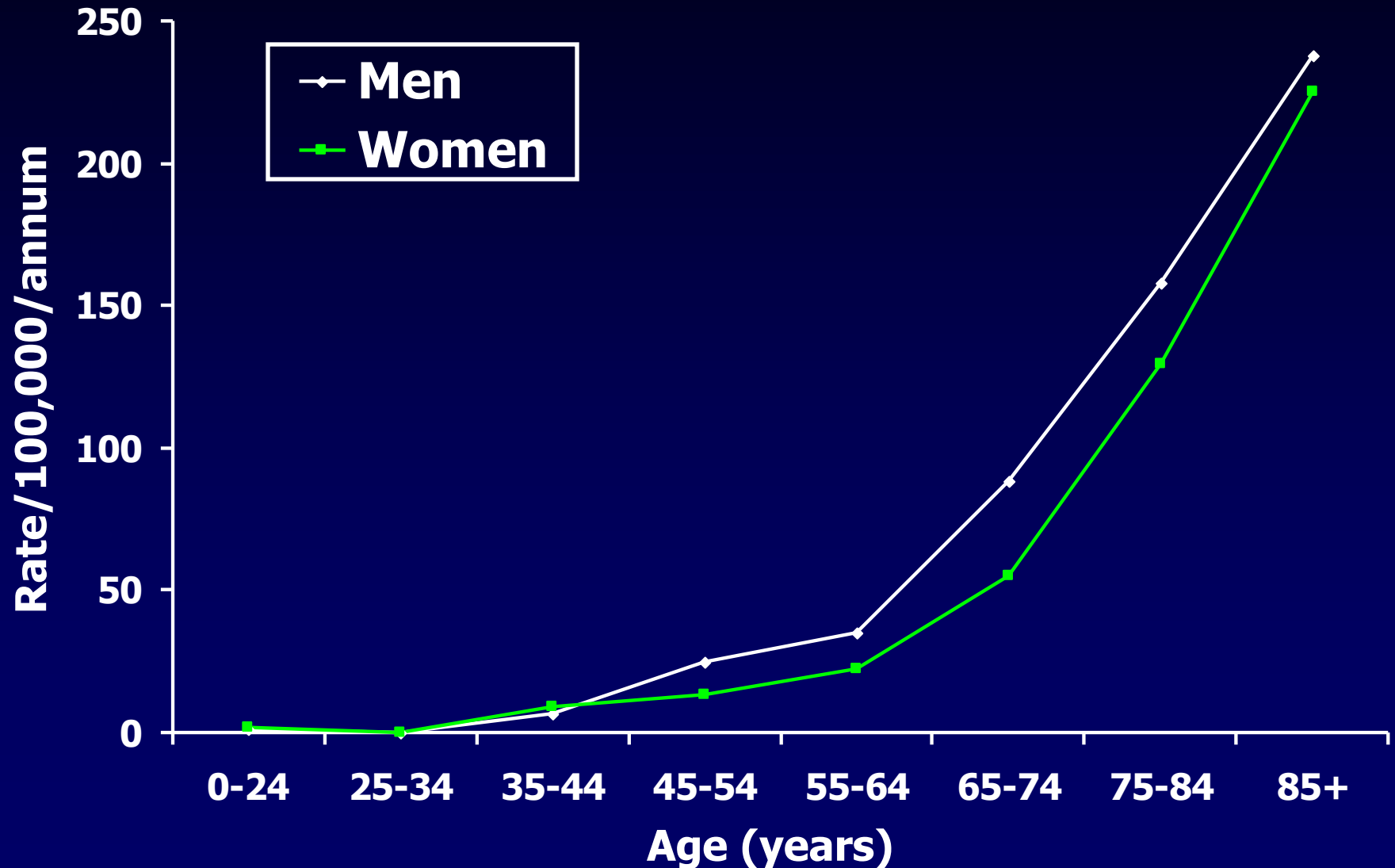
TIA Incidence - Tissue-based

Crude rate 25/100,000



TIA Incidence - All definitions

Crude rate 35/100,000



TIA Incidence in the District of L'Aquila

TIA definition	Total number of included TIA	Crude Incidence (x100,000)	95% CI	Standardized* incidence	95% CI
Tissue-based	151	25.3	21.5-29.6	20.0	16.3-24.1
All definitions	210	35.2	30.7-40.2	28.6	24.1-33.5

CI confidence interval

***to the 2011 European population**

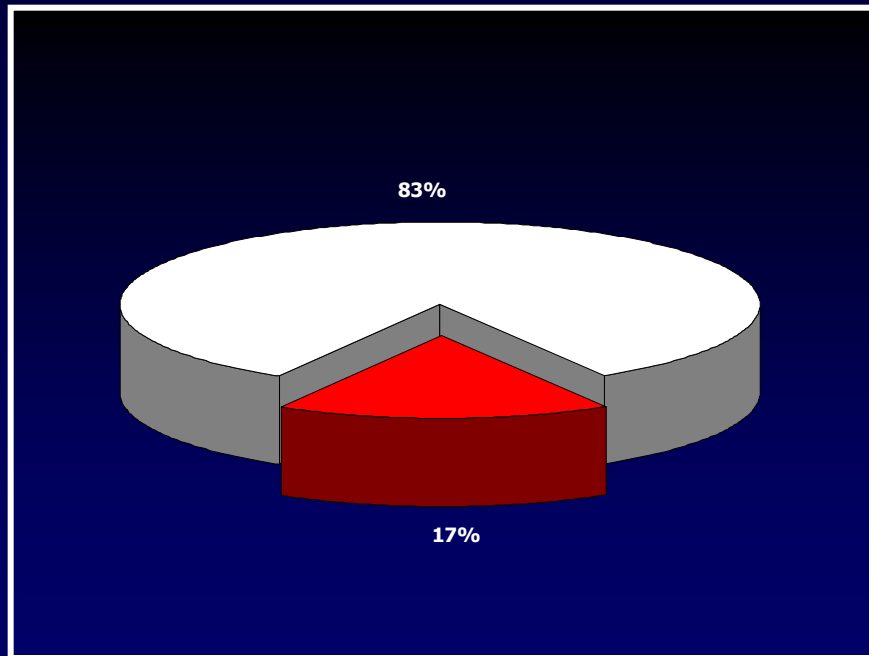
A photograph of a person in a dark suit and white shirt typing on a laptop. The laptop is on a stand. The background is blurred, showing what appears to be a window or office interior. The word "THANKS!" is overlaid in a large, dark blue, serif font.

THANKS!

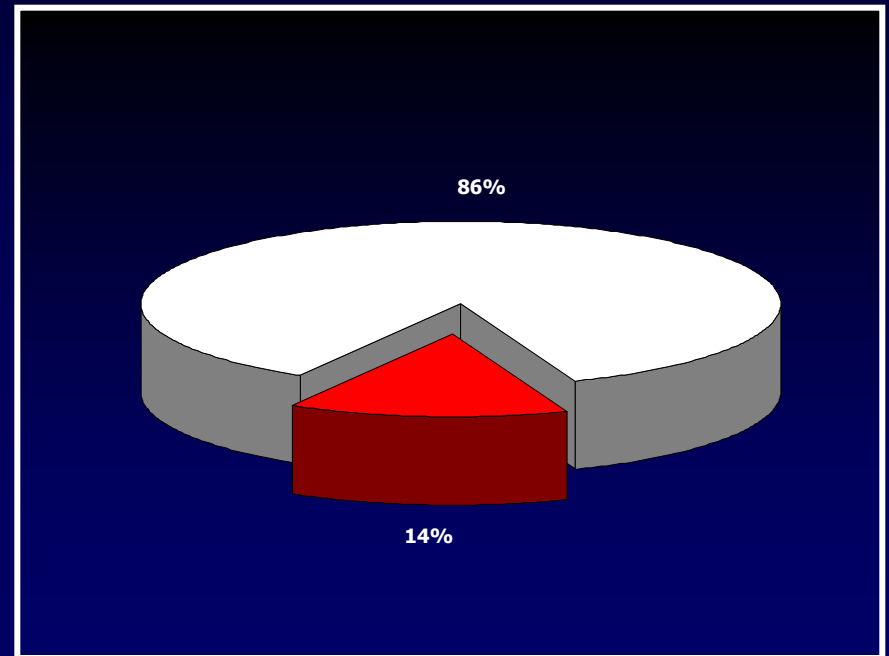
L' Aquila Stroke registry

Distribution of lacunar and nonlacunar strokes

1994-1998



2011-2012



■ *Nonlacunar stroke* ■ *Lacunar stroke*

Demographics of lacunar stroke

1994-1998

Gender	n	Age (years)		
		mean $\pm$ SD	min	max
Men	252	70.6 $\pm$ 10.2	35	97
Women	239	74.9 $\pm$ 9.4	36	91
Both	491	72.7 $\pm$ 10.1	35	97

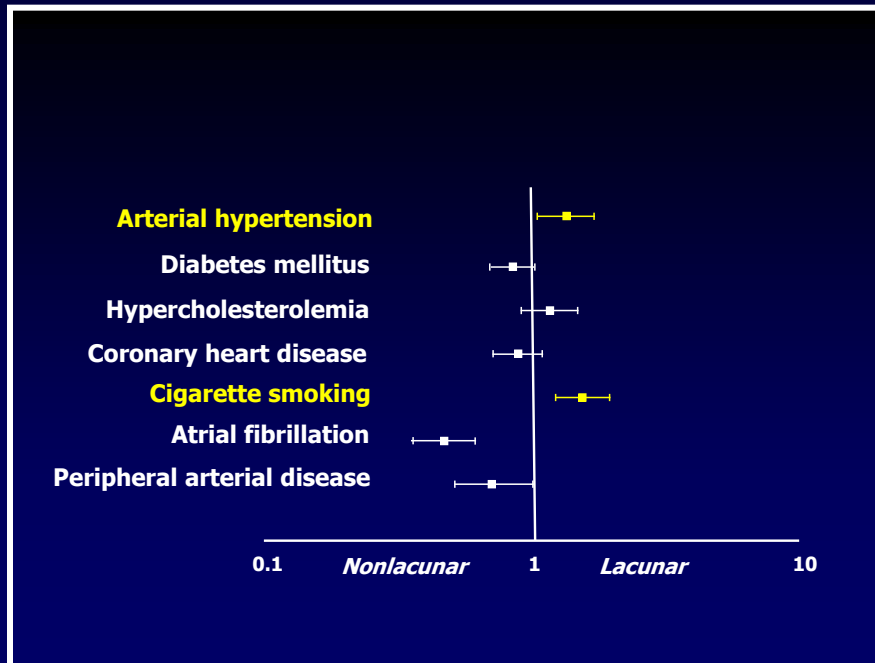
2011-2012

Gender	n	Age (years)		
		mean $\pm$ SD	min	max
Men	57	67.0 $\pm$ 10.6	45	90
Women	35	74.5 $\pm$ 12.1	46	89
Both	92	69.8 $\pm$ 11.7	45	90

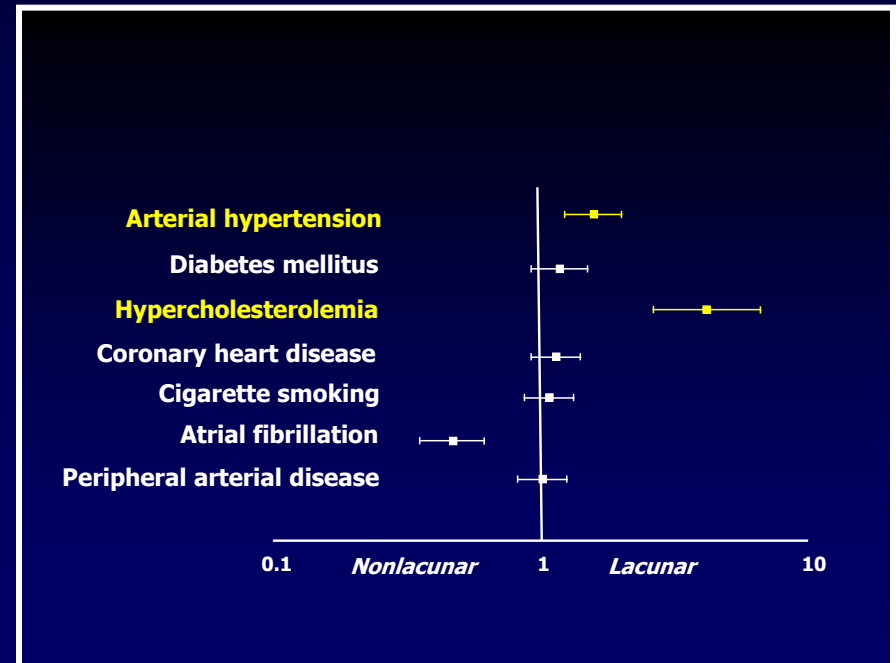
Risk Factors for Lacunar and Nonlacunar Stroke

Multivariate analysis

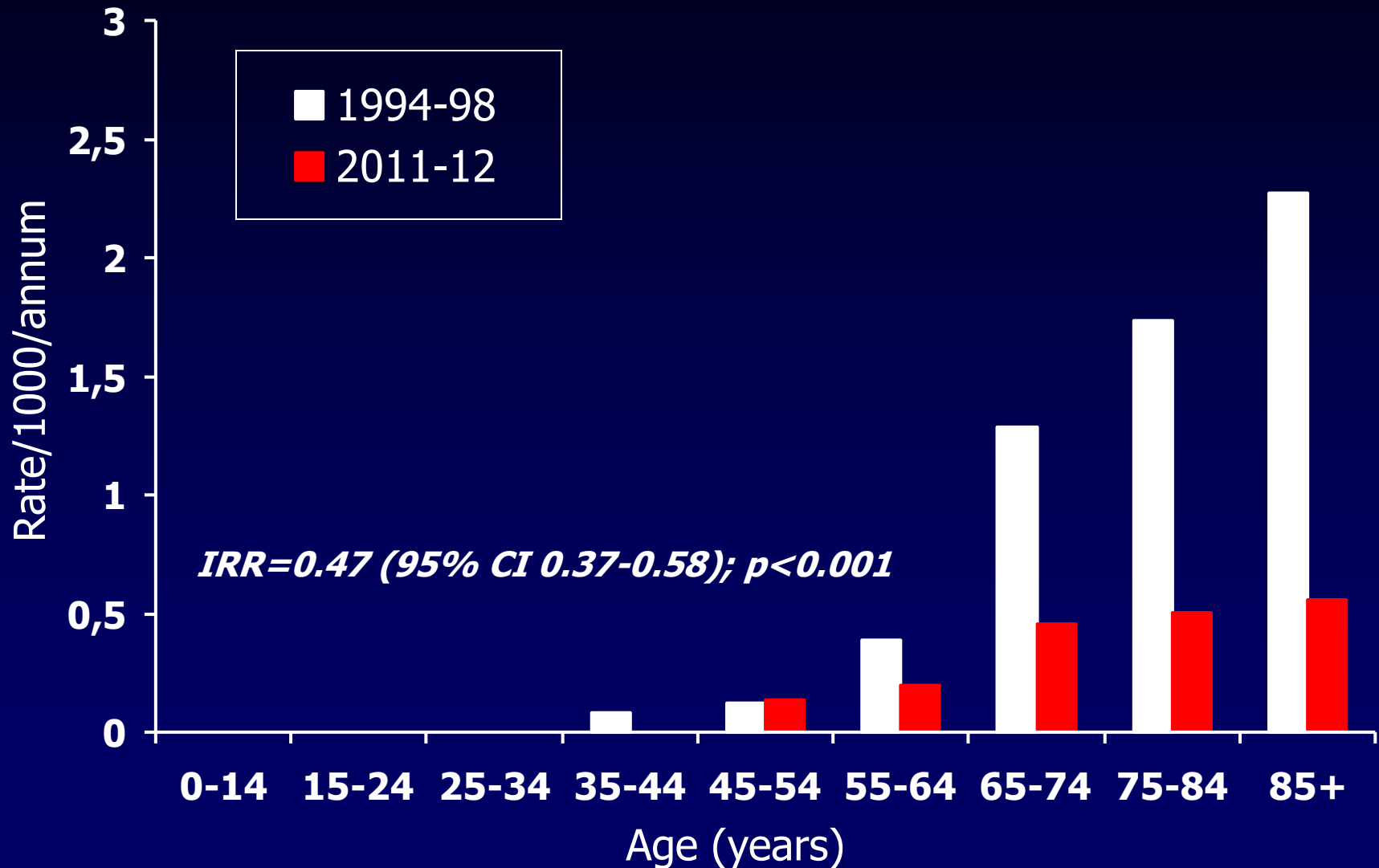
1994-1998



2011-2012



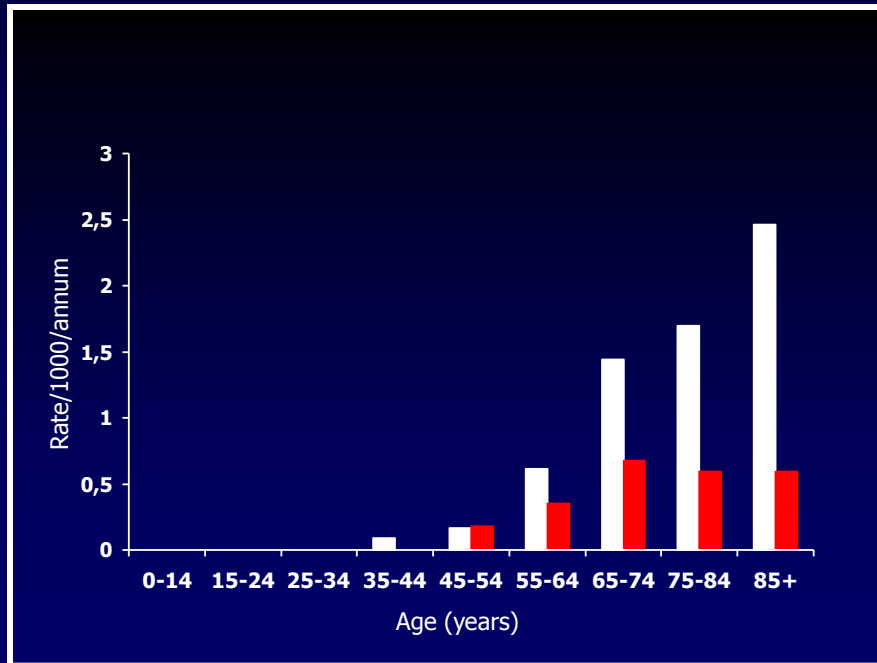
Lacunar Stroke Incidence



Lacunar Stroke Incidence

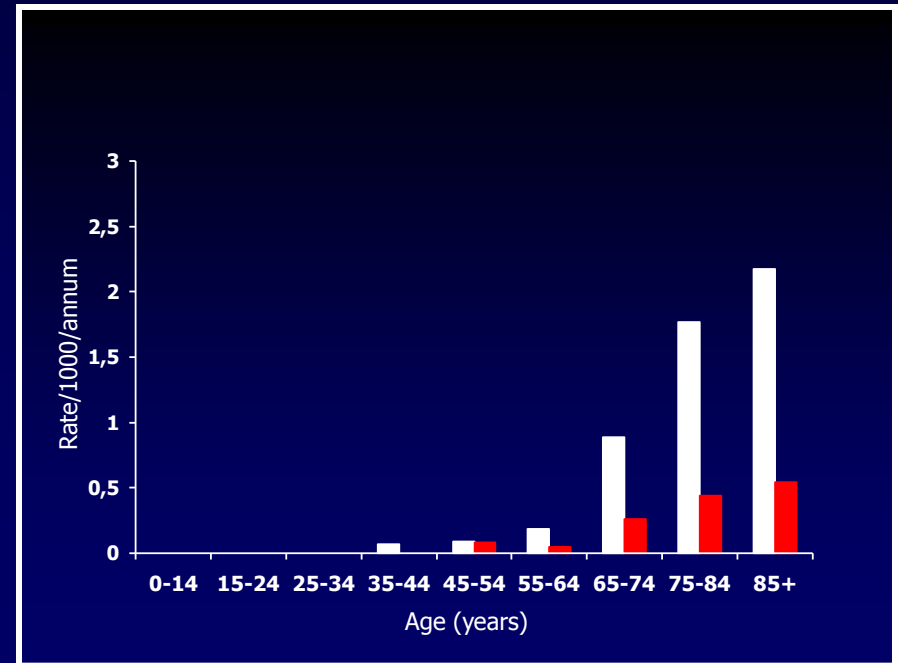
Men

IRR=0.56 (95% CI 0.42-0.74); $p<0.001$



Women

IRR=0.37 (95% CI 0.25-0.52); $p<0.001$

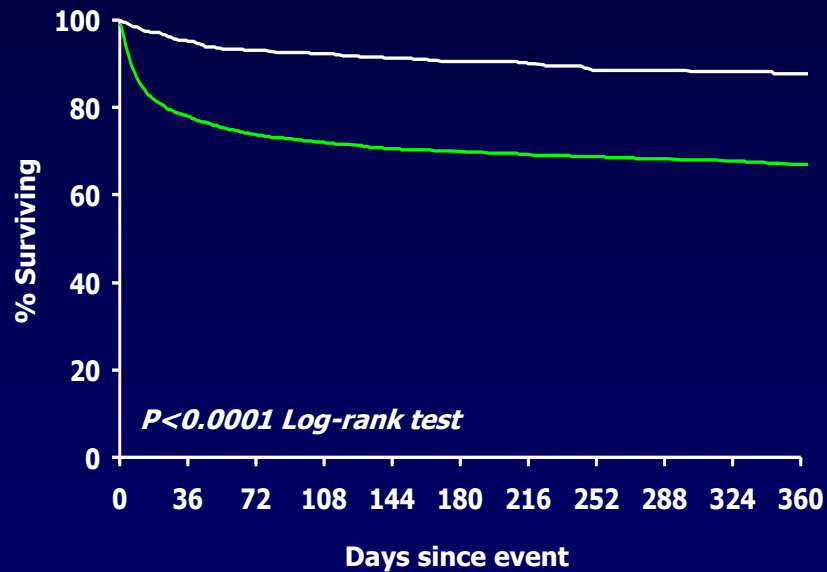


■ 1994-1998 ■ 2011-2012

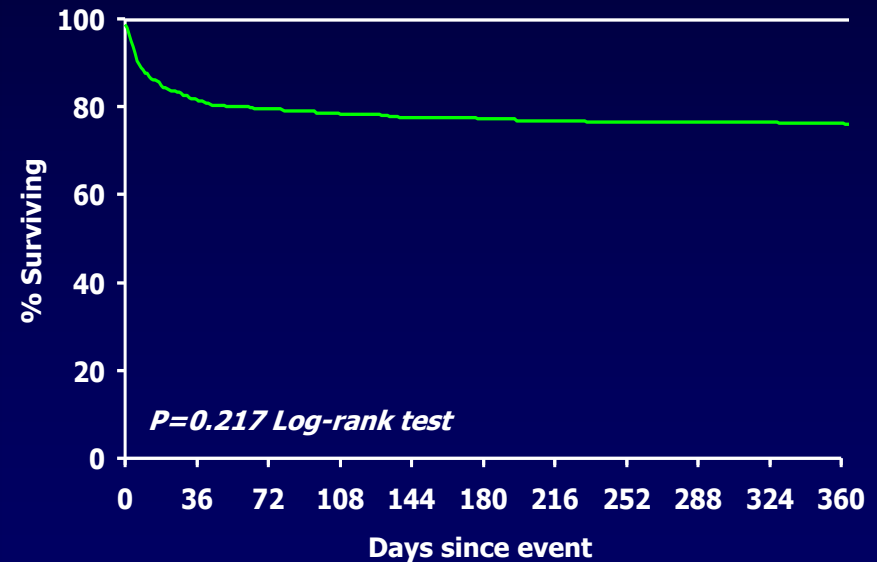
Lacunar vs nonlacunar stroke

1-year survival

1994-1998



2011-2012



■ Lacunar

■ Nonlacunar

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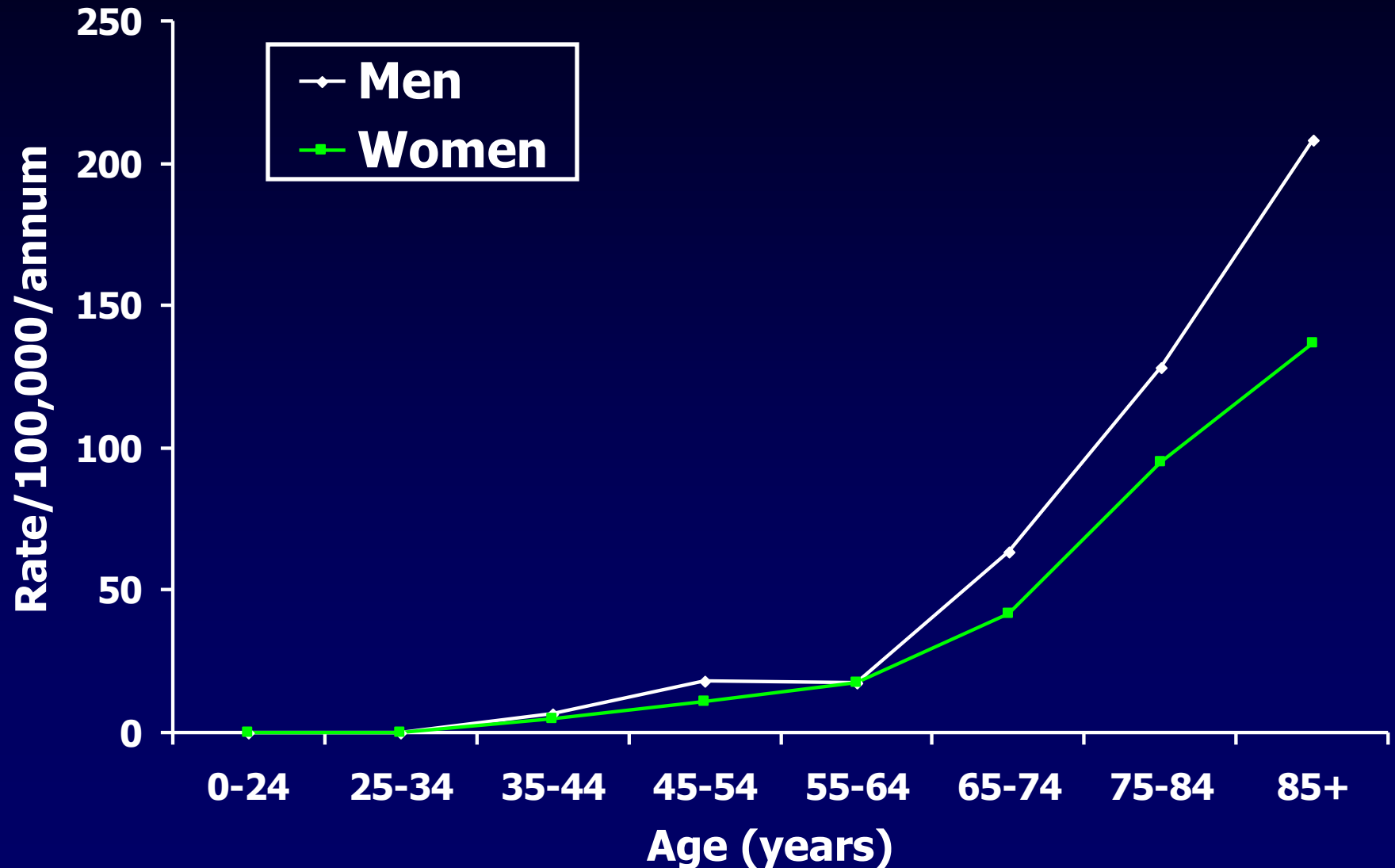
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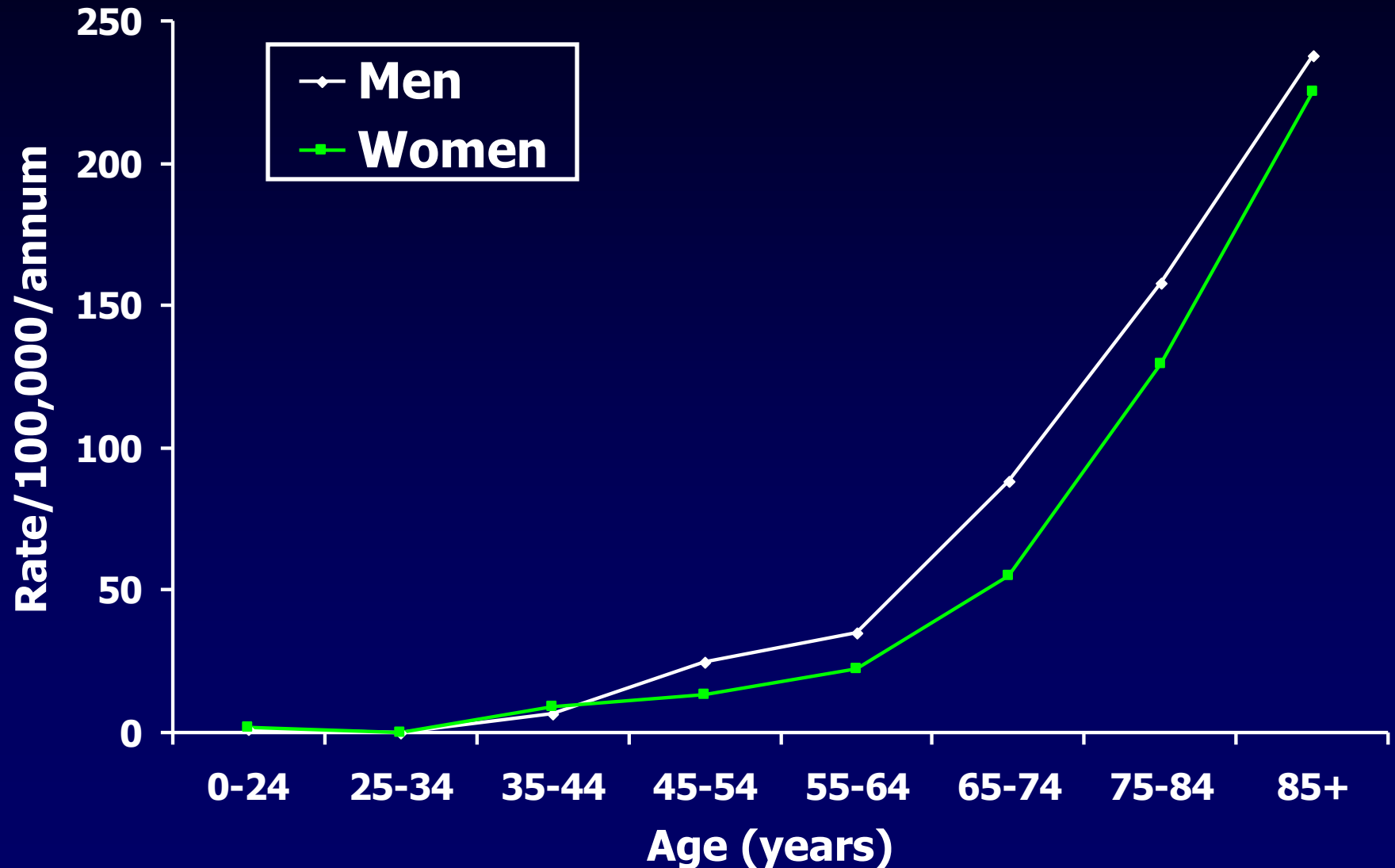
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