

# ISCHAEMIC STROKE IN EUROPE: INCIDENCE TRENDS OVER THREE DECADES (1991–2021)

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## OBJECTIVES

Stroke is a leading cause of adult disability worldwide. In the early 21st century, age-standardized incidence in Europe ranged from 95 to 290 cases per 100,000 population annually, with around 80% of cases being ischaemic strokes. This study aimed to analyse ischaemic stroke (IS) incidence in Europe over the past three decades (1991–2021), focusing on regional differences and variations by sex and age group.

## METHODS

This retrospective, quantitative study used data from the Global Burden of Disease 2021 (GBD 2021) database, accessed via the VizHub platform. Europe was divided into three regions based on GBD classification: Central Europe (CE, 13 countries), Eastern Europe (EE, 7 countries), and Western Europe (WE, 24 countries), covering a total of 44 countries. Data processing and analysis were conducted using MS Excel 2016 and IBM SPSS 25.0. Descriptive statistics were complemented with time series analysis and the Kruskal–Wallis's test ( $p<0.05$ ), followed by pairwise comparisons to assess regional differences.

## RESULTS

From 1991 to 2021, a significant difference in age-specific IS incidence trends was observed between WE and CE, and between WE and EE ( $p<0.05$ ), while CE and EE showed no significant difference ( $p>0.05$ ) (Table 1.). The largest decrease occurred in WE (men:  $-48.4\%$ , women:  $-47.03\%$ ), followed by CE (men:  $-28.1\%$ , women:  $-25.06\%$ ) and EE (men:  $-28.8\%$ , women:  $-32.09\%$ ). By 2021, WE had the lowest, and EE the highest incidence (Table 2.). Across the EU, the average decline was  $55.8\%$  in men and  $43.6\%$  in women. Portugal showed the greatest improvement in both sexes (men:  $-71.01\%$ , women:  $-69.09\%$ ), while in Montenegro, we observed an increase (men:  $+4.1\%$ , women:  $+6.3\%$ ) (Figure 1&2.).

## CONCLUSIONS

The declining IS incidence in Europe suggests improvements in cardiovascular prevention, risk factor management, and healthcare delivery. However, EE still faces a high burden, highlighting the need for targeted public health interventions.

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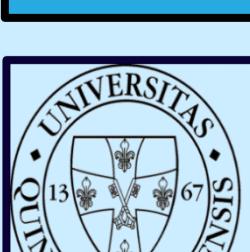
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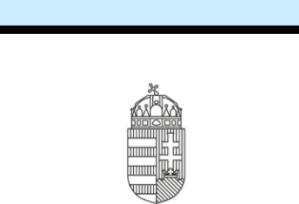
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	Eastern Europe vs. Central Europe	Eastern Europe vs. Western Europe	Central Europe vs. Western Europe
<b>MEN</b>			
1991	$p=0.122$	$p=0.003$	$p<0.001$
2001	$p=0.063$	$p=0.001$	$p<0.001$
2011	$p=0.143$	$p<0.001$	$p<0.001$
2021	$p=0.166$	$p<0.001$	$p<0.001$
<b>WOMEN</b>			
1991	$p=0.104$	$p<0.001$	$p<0.001$
2001	$p=0.104$	$p<0.001$	$p<0.001$
2011	$p=0.285$	$p<0.001$	$p<0.001$
2021	$p=0.552$	$p<0.001$	$p<0.001$

Table 1. Significance levels of pairwise country-group comparisons (Kruskal–Wallis) across the evaluated years

	1991		2001		2011		2021	
REGION	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN
Western Europe	120.7 ( $\pm 26.5$ )	89.5 ( $\pm 20.1$ )	95.0 ( $\pm 25.1$ )	69.1 ( $\pm 17.5$ )	72.1 ( $\pm 22.3$ )	52.1 ( $\pm 14.6$ )	62.3 ( $\pm 14.4$ )	47.2 ( $\pm 10.7$ )
Central Europe	172.1 ( $\pm 49.8$ )	142.4 ( $\pm 42.2$ )	154.5 ( $\pm 50.9$ )	124.6 ( $\pm 44.5$ )	141.3 ( $\pm 48.9$ )	112.4 ( $\pm 46.3$ )	123.8 ( $\pm 43.9$ )	106.0 ( $\pm 45.6$ )
Relative to Western Europe (ratio)	1.4x	1.6x	1.6x	1.8x	2.0x	2.2x	2.0x	2.2x
Eastern Europe	206.7 ( $\pm 35.3$ )	169.8 ( $\pm 27.9$ )	200.3 ( $\pm 39.1$ )	152.3 ( $\pm 31.9$ )	180.6 ( $\pm 51.4$ )	129.2 ( $\pm 31.6$ )	147.1 ( $\pm 32.3$ )	113.9 ( $\pm 25.5$ )
Relative to Western Europe (ratio)	1.7x	1.9x	2.1x	2.2x	2.5x	2.5x	2.4x	2.4x

Table 2. Differences in ischemic stroke incidence across Western, Central, and Eastern Europe (1991–2021)

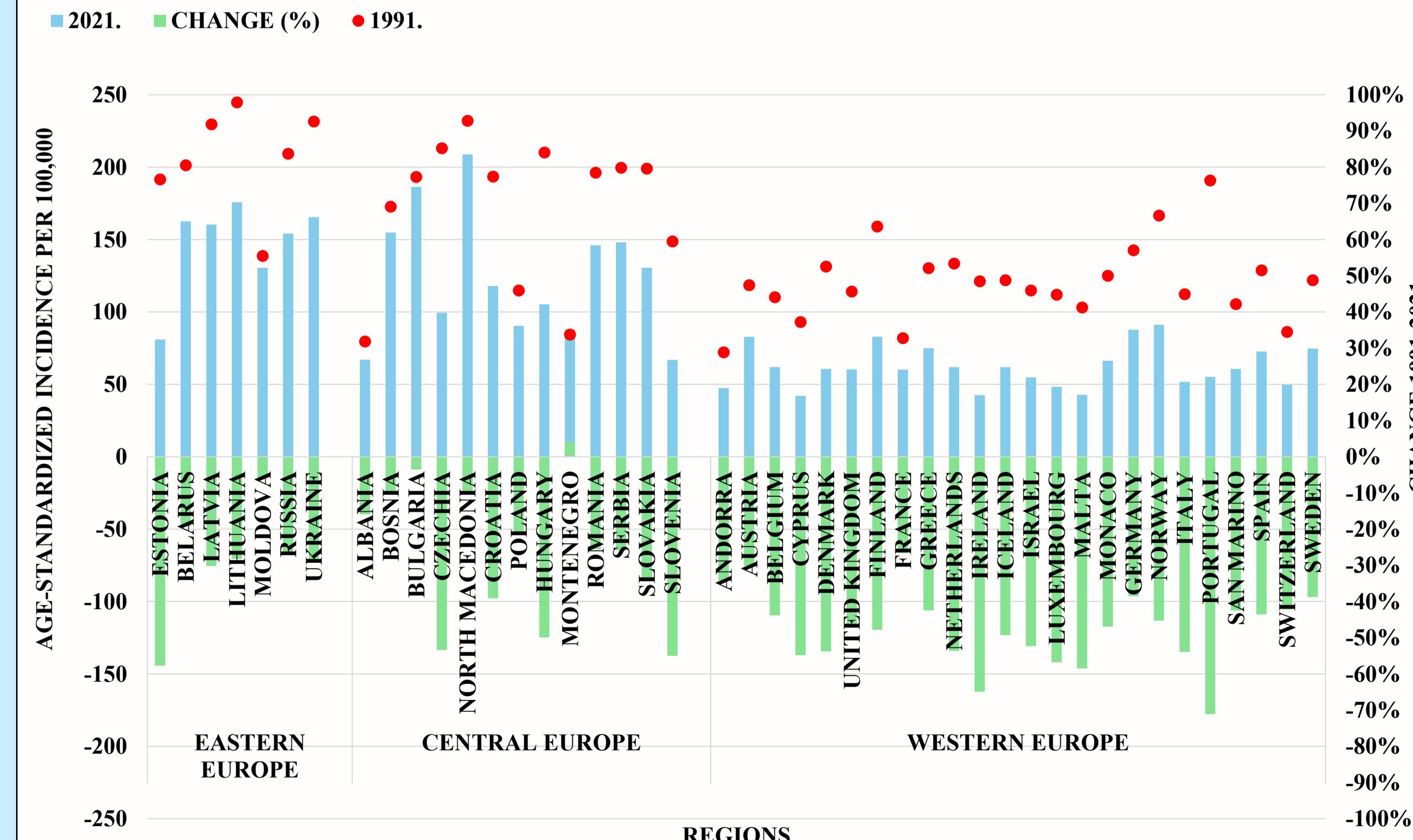
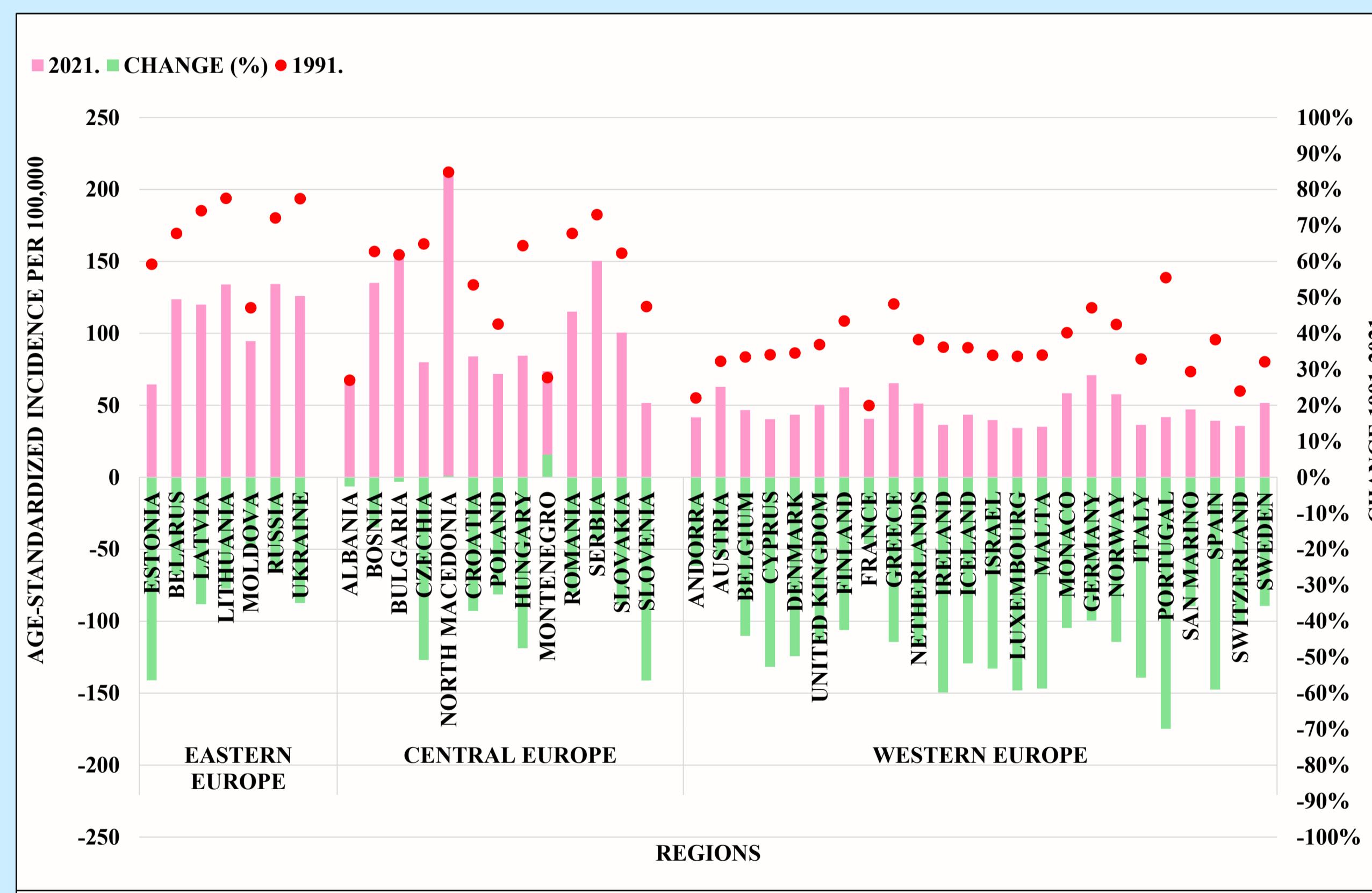


Figure 1 & 2. Change in age-standardized incidence of ischaemic stroke among women (Figure 1.) and men (Figure 2.) between 1991 and 2021, by European country groups