# REGIONAL INEQUALITIES IN YEARS OF LIFE LOST WITHIN THE EUROPEAN ECONOMIC AREA: USING THE GINI COEFFICIENT AND SLOPE INDEX OF INEQUALITY TO ASSESS SPATIAL DISPARITIES

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BACKGROUND I.

- Health inequalities have been linked to reduced life expectations.

- This study aimed to investigate regional variations in all-cause years of life lost (YLLs) in European Economic Area (EEA) countries prior to the COVID-19 pandemic.
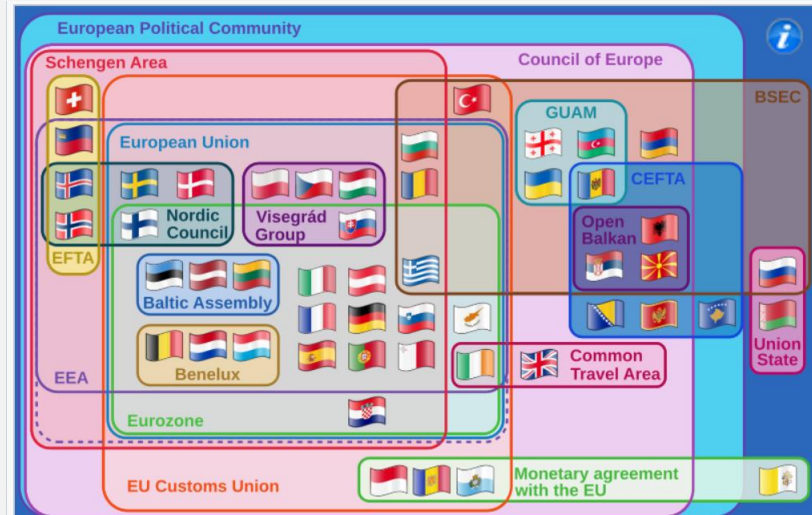
BACKGROUND II.

- Although health inequalities are typically addressed as a European or national concern, they also require action at the subnational level.

- Subnational YLL estimates in the EEA allow for consistent comparisons of geographical inequality in premature mortality across and within countries, and are a key metric in Global Burden of Disease studies.

METHODS I.

- Demographic data were extracted from Eurostat for 1390 small regions 32 EEA countries.

- Age-standardised sex specific YLL rates per 100,000 population in 2019 were estimated for EEA regions (Eurostat **NUTS level 2 and 3**) using methodologies derived from the Global Burden of Disease study.

METHODS II.

- We assessed inequalities:

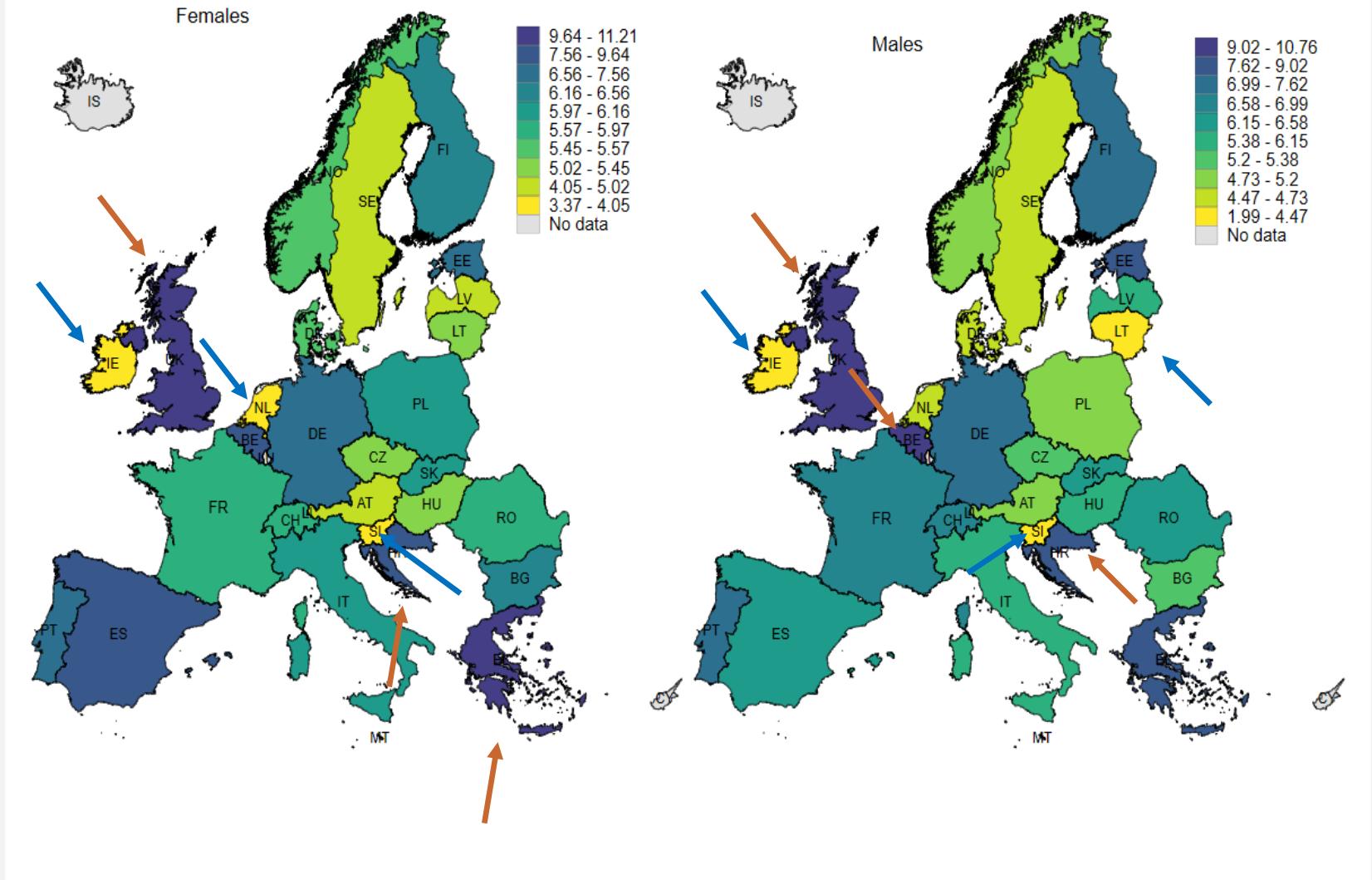1.Relative inequalities (Gini coefficient), between regions (NUTS 3, NUTS 2).

Higher Gini values indicate greater inequality (100% = complete inequality, 0% = equality).

2.Absolute inequalities (slope index of inequality (SII)), across NUTS 2 or NUTS 3 regions.

SII shows the average difference in YLLs between the most and least advantaged regions, based on rankings and population distribution across NUTS 2 or NUTS 3 regions.
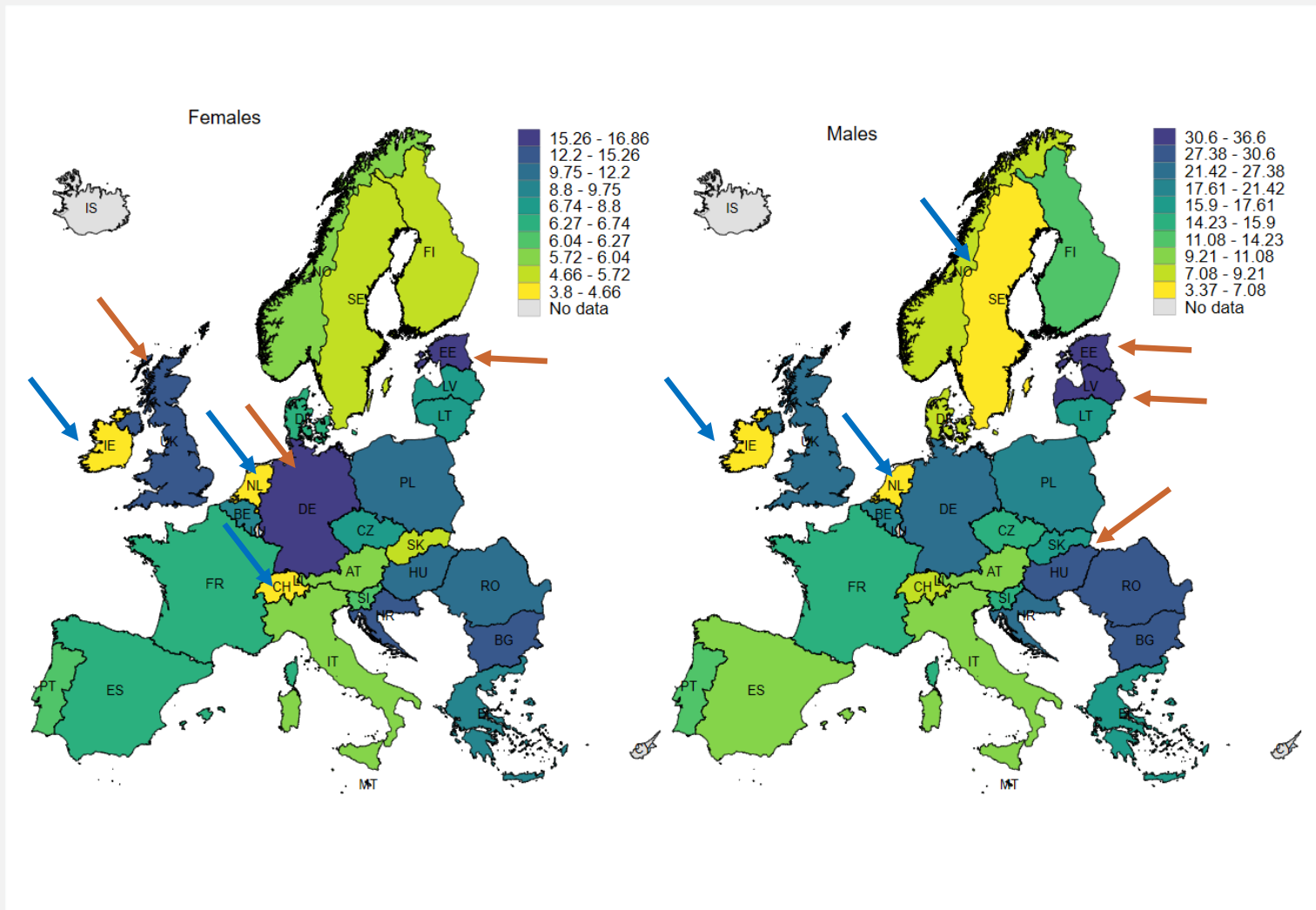
RESULTS I.

- **The relative within-country geographical inequality** in age-standardised YLLs in 2019 by subnational regions (**NUTS 3**), measured by the Gini coefficient, was generally low.

- The overall relative geographical inequality in YLLs was larger between EEA countries rather than within EEA countries, and slightly greater for males (16·96% [16·26–17·65]) than for females (14·22% [13·62–14·82].

Relative within-country inequalities in age-standardised YLL rates for females and males measured using the Gini coefficient based subnational regions (NUTS 3), 2019

RESULTS III.

- In absolute terms, the largest geographical inequality in YLLs in 2019 for all NUTS 3-level regions was 20·43% (20·00 to 20·86) for females and 41·3% (40·03 to 42·49) for males .

Absolute within-country inequalities in age standardised YLL rates for females and males measured using the slope index of inequality based subnational regions (NUTS 3), 2019

RESULTS V.

- Gender differences in relative inequality (2009-2019): Relative geographical inequalities in YLLs decreased for females (AAPC –0.19%) but increased for males (AAPC 0.54%).

- Absolute inequality trends: No significant change in absolute geographical inequality for females, but for males, absolute inequality decreased (βSII = –0.0037).

- Country-specific:

Average annual percentage change (AAPC) in the relative inequalities using Gini coefficient of subnational regions (NUTS 2) YLLs from 2009-2019, per sex and country and across all EEA regions

	Females				Males		
Rank	country	AAPC$_{GC}$	(95% CI)	Rank	Country	AAPC$_{GC}$	(95% CI)
1	Hungary	3·69	(2·05 to 5·37)	1	Romania	5·13	(2·7 to 7·62)
2	Finland	2·53	(-7·5 to 13·65)	2	Norway	2·35	(-1·47 to 6·32)
3	Switzerland	1·87	(-2·2 to 6·11)	3	Switzerland	2·11	(-1·11 to 5·43)
4	Germany	1·76	(0·83 to 2·7)	4	Italy	2	(-0·17 to 4·22)
5	Belgium	1·66	(0·41 to 2·93)	5	Bulgaria	1·81	(-0·59 to 4·27)
6	United Kingdom	1·32	(0·55 to 2·09)	6	Belgium	1·55	(0·83 to 2·27)
7	Sweden	1·29	(-3·18 to 5·97)	7	Hungary	1·31	(-0·28 to 2·92)
8	Czechia	1·09	(-0·52 to 2·72)	8	Greece	0·7	(-1·07 to 2·5)
9	Greece	0·11	(-2·88 to 3·2)	9	Netherlands	0·53	(-3·18 to 4·39)
10	Norway	0·11	(-2·64 to 2·94)	10	Austria	0·51	(-0·81 to 1·85)
11	France	0·04	(-0·72 to 0·81)	11	United Kingdom	0·42	(-0·39 to 1·23)
12	Netherlands	-0·19	(-3·25 to 2·97)	12	Germany	0·2	(-0·47 to 0·88)
13	Spain	-0·22	(-1·64 to 1·22)	13	Czechia	0·02	(-1·13 to 1·18)
14	Denmark	-0·32	(-4·78 to 4·35)	14	Sweden	0·02	(-3·22 to 3·37)
15	Italy	-0·43	(-2·03 to 1·2)	15	Spain	-0·49	(-2·47 to 1·53)
16	Portugal	-0·81	(-3·42 to 1·86)	16	France	-0·51	(-1·19 to 0·17)
17	Bulgaria	-0·97	(-3·97 to 2·12)	17	Portugal	-0·75	(-2·41 to 0·95)
18	Austria	-1·1	(-3·67 to 1·55)	18	Finland	-1·23	(-9·32 to 7·57)
19	Poland	-1·38	(-2·89 to 0·16)	19	Poland	-1·3	(-2·23 to -0·36)
20	Romania	-2·28	(-5·08 to 0·6)	20	Denmark	-4·82	(-8·82 to -0·65)
	EEA	-0·19	(-0·60 to 0·22)		EEA	0·54	(0·19 to 0·89)

Average annual change in the absolute inequalities using slope index of inequality of subnational regions (NUTS 2) YLLs from 2009-2019, per sex and country and across all EEA regions

	Females				Males		
Rank	country	β_{SII}	(95% CI)	**Rank**	Country	β_{SII}	(95% CI)
1	United Kingdom	0·0026	(0·0015 to 0·0036)	1	Romania	0·0059	(0·0021 to 0·0097)
2	Hungary	0·0023	(0·0009 to 0·0037)	2	Bulgaria	0·0019	(-0·0029 to 0·0066)
3	Finland	0·0007	(-0·0026 to 0·0040)	3	United Kingdom	0·0014	(-0·0001 to 0·0030)
4	Germany	0·0005	(0·00005 to 0·0010)	4	Greece	0·0011	(-0·0003 to 0·0024)
5	Switzerland	0·0003	(-0·0011 to 0·0017)	5	Norway	0·0005	(-0·0024 to 0·0034)
6	Belgium	0·0001	(-0·0013 to 0·0016)	6	Switzerland	-0·0004	(-0·0013 to 0·0005)
7	Sweden	-0·0001	(-0·0016 to 0·0015)	7	Italy	-0·0005	(-0·0018 to 0·0007)
8	Spain	-0·0001	(-0·0016 to 0·0013)	8	Hungary	-0·0006	(-0·0050 to 0·0038)
9	Netherlands	-0·0004	(-0·0013 to 0·0006)	9	Netherlands	-0·0008	(-0·0024 to 0·0009)
10	France	-0·0004	(-0·0011 to 0·0003)	10	Sweden	-0·0008	(-0·0029 to 0·0013)
11	Italy	-0·0007	(-0·0017 to 0·0004)	11	Austria	-0·0012	(-0·0027 to 0·0003)
12	Czechia	-0·0008	(-0·0022 to 0·0007)	12	Germany	-0·0014	(-0·0022 to -0·0005)
13	Austria	-0·0008	(-0·0023 to 0·0008)	13	Belgium	-0·0014	(-0·0028 to -0·0001)
14	Greece	-0·0008	(-0·0023 to 0·0008)	14	Spain	-0·0031	(-0·0050 to -0·0012)
15	Norway	-0·0009	(-0·0023 to 0·0005)	15	Czechia	-0·0039	(-0·0062 to -0·0016)
16	Portugal	-0·0012	(-0·0045 to 0·0022)	16	Finland	-0·0043	(-0·0110 to 0·0025)
17	Denmark	-0·0012	(-0·0033 to 0·0009)	17	France	-0·0046	(-0·0065 to -0·0026)
18	Poland	-0·0023	(-0·0041 to -0·0006)	18	Poland	-0·0047	(-0·0068 to -0·0026)
19	Romania	-0·0024	(-0·0045 to -0·0004)	19	Denmark	-0·0051	(-0·0083 to -0·0020)
20	Bulgaria	-0·0026	(-0·0070 to 0·0017)	20	Portugal	-0·0063	(-0·0122 to -0·0003)
		…				…	
	EEA	-0·0026	(-0·0035 to 0·0018)		EEA	-0·0037	(-0·0053 to -0·0021)

CONCLUSIONS I.

- Relative and absolute disparities in premature mortality rates are evident across regions of the EEA, both within countries and across the entire region.

- Insights from the study guide the development of targeted regional policies and resource allocation to address health disparities, as national estimates may overlook subnational inequalities.

CONCLUSIONS II.

- Recognizing regional health disparities helps inform equitable distribution of health resources, emphasizing the importance of small-scale regional policies.

- The findings support EU cohesion policy goals, highlighting the need to invest in health to address economic and social disparities for regional development and competitiveness.

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Subnational inequalities in years of life lost and associations with socioeconomic factors in pre-pandemic Europe, 2009–19: an ecological study

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