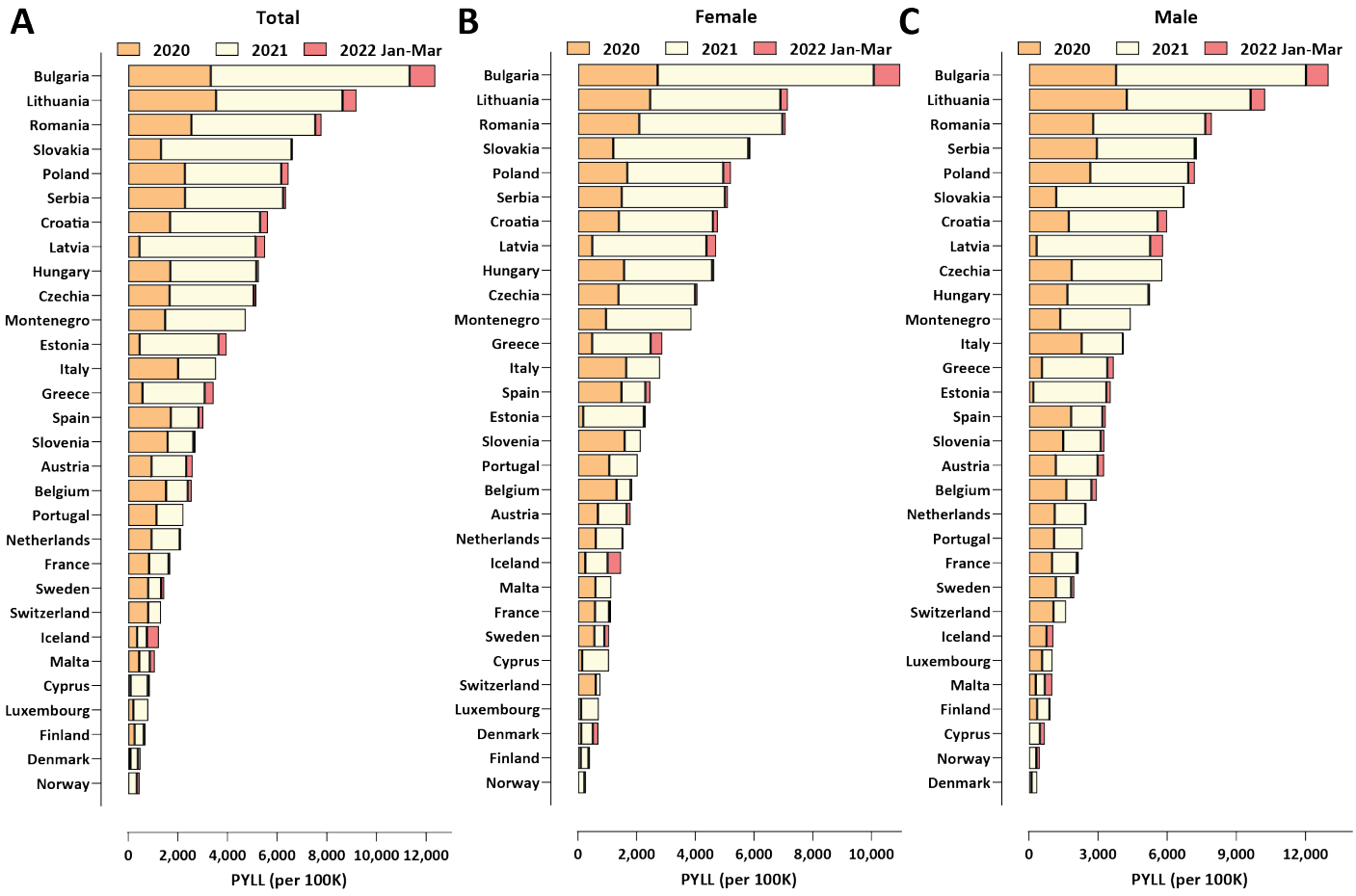
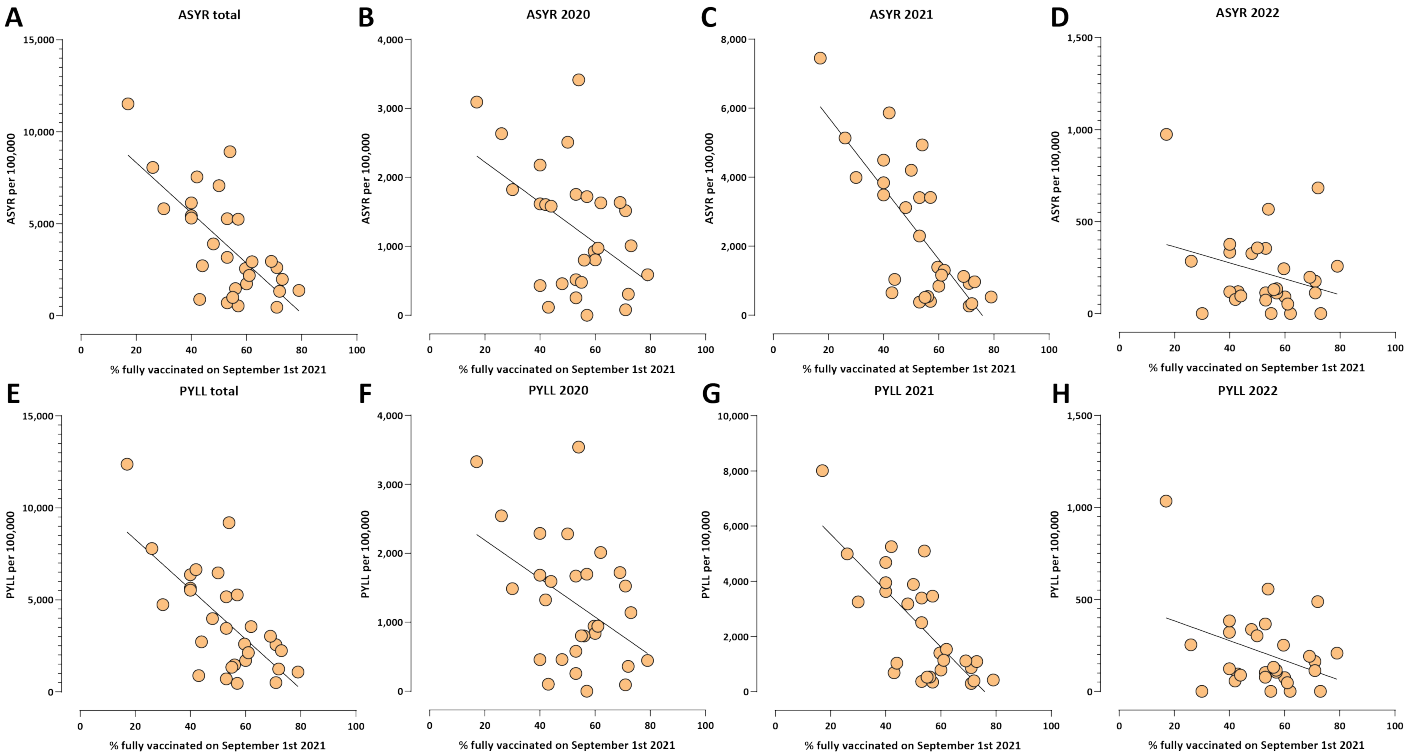
Supplementary Materials

Supplementary Figures



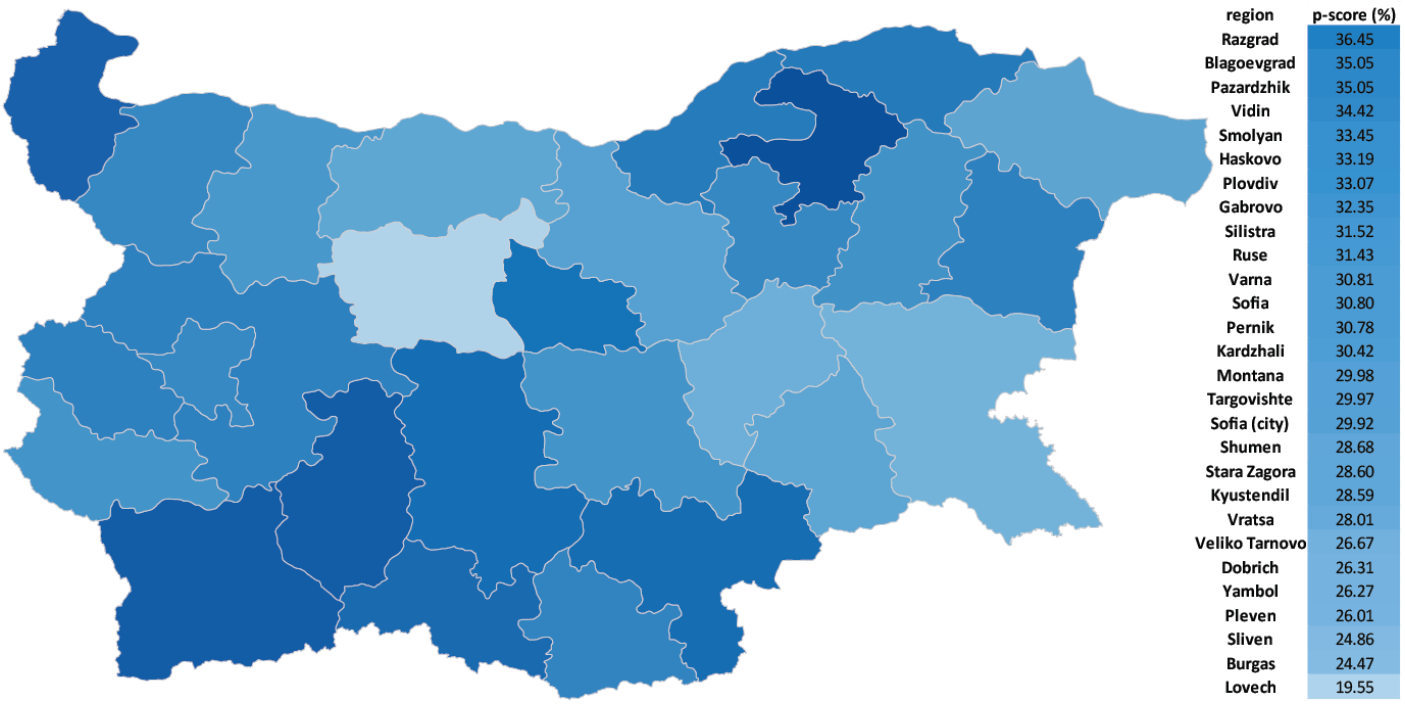
Supplementary Figure 1: Excess mortality in Europe and Bulgaria during the COVID-19 pandemic (up to the end of March 2022). (A) Standardized PYLL values, total; (B) Standardized PYLL values, females; (C) Standardized PYLL values, males.



Supplementary Figure 2: Correlation between rates of full vaccination and ASYR and PYLL excess mortality measures in European countries.
(A) ASYR, total (Pearson $R^2 = 0.5$, $p \leq 0.0001$; Spearman $r = -0.64$, $p = 0.0002$);
(B) ASYR, 2020 (Pearson $R^2 = 0.22$, $p = 0.0105$; Spearman $r = -0.36$, $p = 0.0549$);
(C) ASYR, 2021 (Pearson $R^2 = 0.57$, $p \leq 0.0001$; Spearman $r = -0.69$, $p \leq 0.0001$);
(D) ASYR, 2022 (Pearson $R^2 = 0.08$, $p = 0.1286$; Spearman $r = -0.2$, $p = 0.2982$);
(E) PYLL, total (Pearson $R^2 = 0.47$, $p \leq 0.0001$; Spearman $r = -0.62$, $p = 0.0003$);
(F) PYLL, 2020 (Pearson $R^2 = 0.19$, $p = 0.0169$; Spearman $r = -0.32$, $p = 0.08$);
(G) PYLL, 2021 (Pearson $R^2 = 0.56$, $p \leq 0.0001$; Spearman $r = -0.65$, $p = 0.0001$);
(H) PYLL, 2022 (Pearson $R^2 = 0.13$, $p = 0.0523$; Spearman $r = -0.19$, $p = 0.3106$).

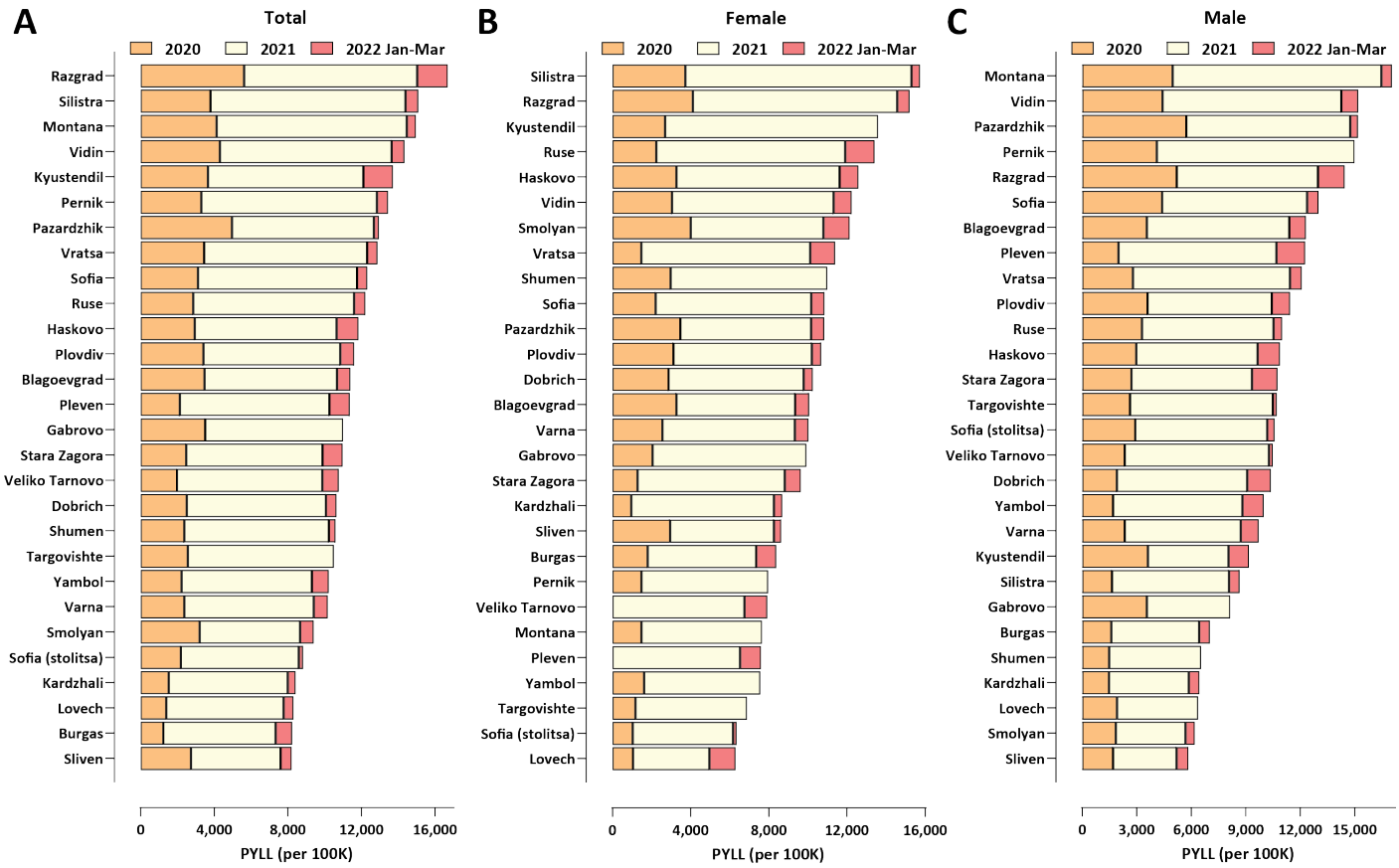
	ASYR			PYLL		
	all	male	female	all	male	female
Austria	12.17	14.38	8.98	12.32	13.38	10.36
Belgium	11.84	14.05	8.31	11.59	12.49	9.23
Bulgaria	11.70	12.70	10.43	12.57	12.02	12.51
Croatia	11.33	12.99	9.53	11.75	11.51	11.23
Cyprus	16.54	n/a	24.30	16.48	n/a	22.38
Czechia	12.84	14.48	10.70	12.58	12.57	11.67
Denmark	10.29	7.62	16.74	11.26	8.04	17.70
Estonia	14.32	17.65	9.17	14.59	15.29	11.52
Finland	15.56	19.03	7.86	15.56	17.64	10.08
France	12.71	14.37	9.31	12.47	12.82	10.31
Greece	12.94	13.84	10.61	14.10	14.07	12.60
Hungary	14.97	15.98	13.21	15.02	14.18	14.57
Iceland	24.40	27.33	22.86	22.87	23.46	21.12
Italy	9.47	11.27	7.52	11.45	12.21	10.37
Latvia	13.20	17.17	9.07	13.74	15.42	11.50
Lithuania	13.94	16.27	10.41	14.38	14.57	12.40
Luxembourg	27.49	26.56	18.90	27.01	25.21	19.48
Malta	12.83	18.13	10.36	10.07	13.11	9.41
Montenegro	13.37	13.95	12.22	10.90	9.74	10.96
Netherlands	12.00	12.96	11.03	11.68	11.56	11.56
Poland	14.80	16.99	12.03	13.54	13.47	12.39
Portugal	9.31	11.19	7.96	10.51	11.03	10.26
Romania	13.10	14.08	12.00	12.66	11.86	12.93
Serbia	12.30	13.17	11.05	12.75	12.48	12.46
Slovakia	15.55	17.54	13.01	13.68	13.41	12.82
Slovenia	11.34	14.53	7.70	11.34	12.12	9.29
Spain	12.62	13.93	10.19	12.91	12.83	11.63
Sweden	11.27	13.38	8.34	11.19	12.34	9.38
Switzerland	7.53	9.76	3.50	10.07	11.23	7.18

Supplementary Figure 3: Year of life lost per excess death in European countries. Note that the very high values for a few countries (e.g. Cyprus, Iceland, Luxembourg, Finland, Malta) might be artifacts resulting from significantly insignificant excess deaths (z-score significantly below 2).

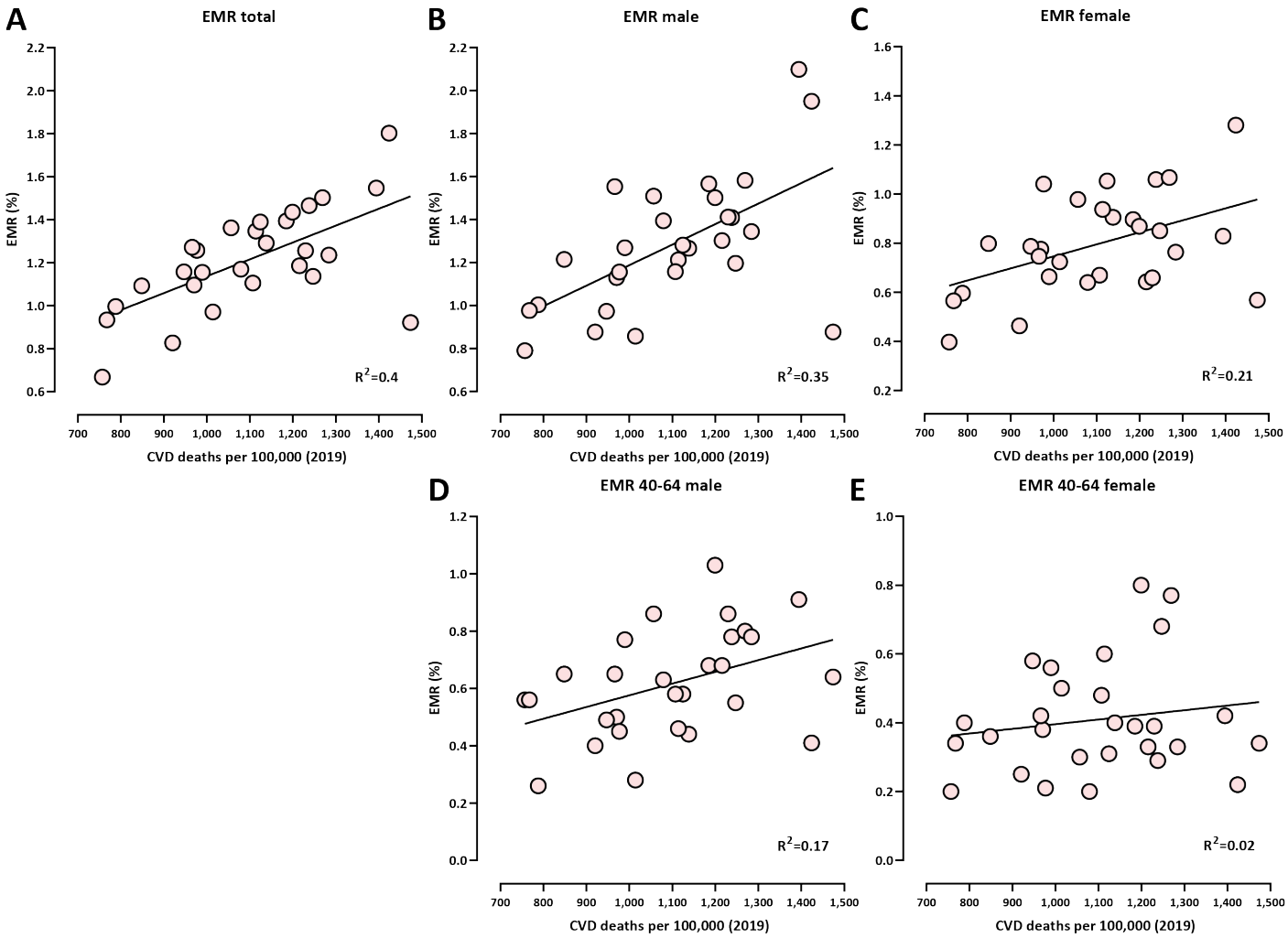


region	p-score (%)
Razgrad	36.45
Blagoevgrad	35.05
Pazardzhik	35.05
Vidin	34.42
Smolyan	33.45
Haskovo	33.19
Plovdiv	33.07
Gabrovo	32.35
Silistra	31.52
Ruse	31.43
Varna	30.81
Sofia	30.80
Pernik	30.78
Kardzhali	30.42
Montana	29.98
Targovishte	29.97
Sofia (city)	29.92
Shumen	28.68
Stara Zagora	28.60
Kyustendil	28.59
Vratsa	28.01
Veliko Tarnovo	26.67
Dobrich	26.31
Yambol	26.27
Pleven	26.01
Sliven	24.86
Burgas	24.47
Lovech	19.55

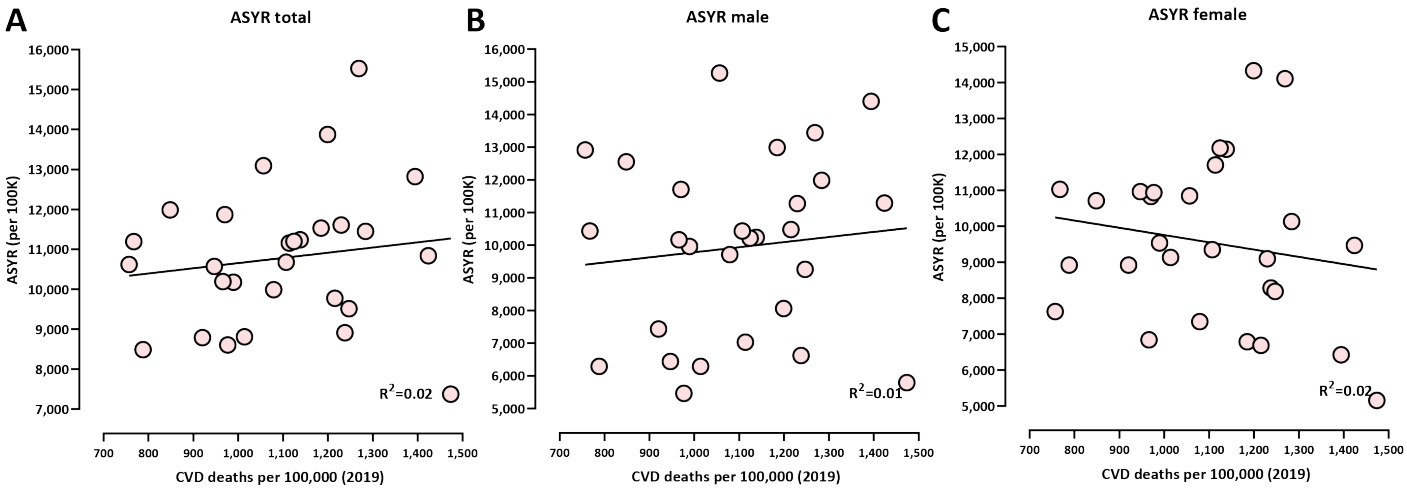
Supplementary Figure 4: Excess mortality in Bulgarian regions (P-scores).



Supplementary Figure 5: Regional excess mortality patterns in Bulgaria during the COVID-19 pandemic (up to the end of March 2022). (A) Total, standardized PYLL values; (B) Female, standardized PYLL values; (C) Male, standardized PYLL values.



Supplementary Figure 6: Correlation between cardiovascular disease (CVD) prevalence (measured as the deaths from CVD per 100,000 people in 2019) and COVID-related excess mortality in Bulgarian regions (as measured by EMR). Shown is the Pearson R^2 correlation coefficient.
(A) total (Pearson $R^2 = 0.4$, $p = 0.0003$; Spearman $r = 0.59$, $p = 0.0008$);
(B) males (Pearson $R^2 = 0.35$, $p = 0.0009$; Spearman $r = 0.57$, $p = 0.0014$);
(C) females (Pearson $R^2 = 0.21$, $p = 0.0129$; Spearman $r = 0.43$, $p = 0.0196$);
(D) males ages 40-64 (Pearson $R^2 = 0.17$, $p = 0.026$; Spearman $r = 0.43$, $p = 0.0214$);
(E) females ages 40-64 (Pearson $R^2 = 0.02$, $p = 0.41$; Spearman $r = 0.12$, $p = 0.51$).



Supplementary Figure 7: Correlation between cardiovascular disease (CVD) prevalence (measured as the deaths from CVD per 100,000 people in 2019) and COVID-related excess mortality in Bulgarian regions (as measured by ASYR). Shown is the Pearson R^2 correlation coefficient.
(A) total (Pearson $R^2 = 0.02$, $p = 0.47$; Spearman $r = 0.18$, $p = 0.35$);
(B) males (Pearson $R^2 = 0.01$, $p = 0.31$; Spearman $r = 0.15$, $p = 0.44$);
(C) females (Pearson $R^2 = 0.03$, $p = 0.79$; Spearman $r = -0.16$, $p = 0.40$).