Online Resource 8. Age-specific trends and pandemic-period rate ratios

Article: Age–period–cohort effects on suicide mortality in Andalusia, Spain (2000–2024): demographic masking and sustained pandemic excess

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Authors: Carlos Romero-Olóriz[1], Esperanza López Hidalgo[2], María Victoria Villalba Soria[2], Miguel Guerrero Díaz[3]*

[1] Andalusian Emergency Health Centre 061 (CES-061), Provincial Service of Malaga, Malaga, Spain. [2] Institute of Legal Medicine and Forensic Sciences of Malaga, Malaga, Spain. [3] Clinical Management Unit of Mental Health, University Hospital Virgen de la Victoria, Malaga, Spain.

*** Corresponding author:** Miguel Guerrero Díaz. Coordinator of Community Mental Health Unit Marbella, Centro de Salud Las Albarizas, Avenida Las Albarizas s/n, 29600-Marbella (Malaga), Spain. Email: miguel.guerrero.diaz.sspa@juntadeandalucia.es. ORCID: 0000-0002-3066-5930

This Online Resource presents the full age-stratified analysis of suicide mortality trends (2000–2024) and pandemic-period rate ratios. Two complementary approaches are reported: (1) the estimated annual percentage change (EAPC) from log-linear regression over the full 25-year period, stratified by age group and sex, and (2) rate ratios comparing mean suicide rates in the pandemic quinquennium (2020–2024) versus the immediately preceding period (2015–2019), by age group.

1. Full-period age-specific EAPC (2000–2024)

Table S9a. Estimated annual percentage change (EAPC) in age-specific suicide rates by sex, Andalusia 2000–2024

Age group	Both sexes			Men			Women		
	EAPC (%)	95% CI	p	EAPC (%)	95% CI	p	EAPC (%)	95% CI	p
15–29	**–2.10**	**–3.12, –1.07**	**< 0.001**	**–2.52**	**–3.68, –1.35**	**< 0.001**	–0.88	–3.02, +1.30	0.442
30–39	–0.42	–1.38, +0.55	0.407	–0.68	–1.72, +0.37	0.213	+0.32	–1.68, +2.37	0.750
40–44	–0.27	–1.53, +1.01	0.694	–0.31	–1.68, +1.08	0.675	–0.15	–2.65, +2.41	0.928
45–49	+0.08	–1.05, +1.22	0.889	–0.07	–1.28, +1.15	0.920	+0.45	–1.68, +2.62	0.682
50–54	+0.18	–0.85, +1.22	0.731	+0.06	–1.08, +1.21	0.917	+0.48	–1.62, +2.62	0.650
55–59	–0.08	–1.26, +1.12	0.906	–0.38	–1.64, +0.89	0.566	+0.58	–1.82, +3.04	0.634
60–64	+0.21	–1.09, +1.53	0.752	+0.04	–1.38, +1.48	0.957	+0.65	–1.95, +3.32	0.618
65–69	**–1.37**	**–2.46, –0.27**	**0.014**	**–1.71**	**–2.90, –0.51**	**0.005**	–0.62	–3.18, +1.98	0.651
70–74	**–2.17**	**–3.25, –1.07**	**< 0.001**	**–2.55**	**–3.72, –1.36**	**< 0.001**	–1.23	–3.85, +1.45	0.381
75–79	**–2.20**	**–3.55, –0.83**	**< 0.001**	**–2.48**	**–4.00, –0.93**	**0.001**	–1.52	–4.52, +1.55	0.342
80–84	**–2.00**	**–3.38, –0.60**	**0.004**	**–2.21**	**–3.78, –0.62**	**0.006**	–1.45	–4.48, +1.67	0.372
≥85	**–3.79**	**–5.25, –2.30**	**< 0.001**	**–4.38**	**–6.02, –2.70**	**< 0.001**	–2.54	–5.82, +0.84	0.148

EAPC: estimated annual percentage change from log-linear regression (ln[rate] = α + β × year) over the full period 2000–2024. 95% CI from the standard error of the slope coefficient. Bold: statistically significant (p < 0.05). Rates: age-specific crude suicide rates per 100,000 population. Source: INE; authors' calculations.

The full-period trend analysis revealed a clear age-dependent pattern. Significant declines were concentrated at the extremes of the age distribution: the youngest group (15–29: EAPC = –2.10%, p < 0.001) and all groups aged 65 and above (EAPCs ranging from –1.37% in 65–69 to –3.79% in ≥85). The steepest decline was observed in the ≥85 group (EAPC = –3.79%; 95% CI: –5.25 to –2.30). In contrast, the working-age groups (30–64) showed no significant trends, with EAPCs close to zero (–0.42% to +0.21%).

Sex-stratified results showed that the declining trends were driven primarily by men, who exhibited significant decreases in the same age groups but with steeper slopes (e.g. men ≥85: EAPC = –4.38% vs both sexes: –3.79%). In women, no age group reached statistical significance, reflecting both the lower event counts and genuinely flatter trends in female suicide rates. This sex differential is consistent with the absence of significant joinpoints in women's age-standardised rates (Online Resource 6).

2. Pandemic-period rate ratios (2020–2024 vs 2015–2019)

Table S9b. Age-specific suicide rate ratios, pandemic quinquennium (2020–2024) versus pre-pandemic quinquennium (2015–2019), both sexes, Andalusia

Age group	Rate 2015–19	Rate 2020–24	Δ abs.	Δ rel.	RR	95% CI	p	Sig.
15–29	**3.15**	**4.05**	**+0.90**	**+28.6%**	**1.29**	**1.07–1.54**	**0.007**	**↑***
30–39	**6.53**	**8.39**	**+1.86**	**+28.5%**	**1.29**	**1.12–1.48**	**< 0.001**	**↑***
40–44	**8.87**	**10.93**	**+2.05**	**+23.1%**	**1.23**	**1.08–1.41**	**0.002**	**↑***
45–49	**10.72**	**13.20**	**+2.49**	**+23.2%**	**1.23**	**1.12–1.35**	**< 0.001**	**↑***
50–54	**12.10**	**14.44**	**+2.33**	**+19.3%**	**1.19**	**1.12–1.27**	**< 0.001**	**↑***
55–59	12.21	14.03	+1.82	+14.9%	1.15	0.96–1.37	0.127	—
60–64	**11.04**	**14.09**	**+3.05**	**+27.6%**	**1.28**	**1.10–1.47**	**< 0.001**	**↑***

Age group	Rate 2015–19	Rate 2020–24	Δ abs.	Δ rel.	RR	95% CI	p	Sig.
65–69	11.00	12.81	+1.81	+16.5%	1.16	0.92–1.47	0.198	—
70–74	12.65	13.22	+0.57	+4.5%	1.04	0.88–1.25	0.625	—
75–79	16.95	16.12	–0.83	–4.9%	0.95	0.70–1.29	0.746	↓
80–84	19.91	20.57	+0.66	+3.3%	1.03	0.80–1.34	0.803	—
≥85	10.74	11.69	+0.94	+8.8%	1.09	0.81–1.45	0.568	—

Rate: mean crude suicide rate per 100,000 for the quinquennium. RR: rate ratio (2020–2024 / 2015–2019). 95% CI: delta method on the variance of annual rates within each quinquennium. Δ abs.: absolute rate difference. Δ rel.: relative change. ↑: significant increase ($p < 0.05$). ↓: decrease (not significant). —: no significant change. Source: INE; authors' calculations.*

The pandemic-period analysis revealed a strikingly heterogeneous impact by age. Six of 12 age groups showed significant rate increases, all in the population under 65: 15–29 (RR = 1.29; $p = 0.007$), 30–39 (RR = 1.29; $p < 0.001$), 40–44 (RR = 1.23; $p = 0.002$), 45–49 (RR = 1.23; $p < 0.001$), 50–54 (RR = 1.19; $p < 0.001$), and 60–64 (RR = 1.28; $p < 0.001$). The largest absolute increase was in the 60–64 group (Δ = +3.05/100,000), while the largest relative increases were in the youngest groups (15–29 and 30–39: both +28.5–28.6%).

In contrast, no age group above 70 showed significant changes. The 75–79 group was the only one with a rate ratio below unity (RR = 0.95), although this was not significant ($p = 0.746$). This age-gradient in pandemic impact—with greatest excess among working-age adults and minimal change among the elderly—contrasts sharply with the direct mortality burden of COVID-19, which was concentrated in the oldest age groups, and suggests that the mechanisms driving the suicide excess are predominantly indirect (psychosocial, economic, and service-disruption pathways).

3. Figures

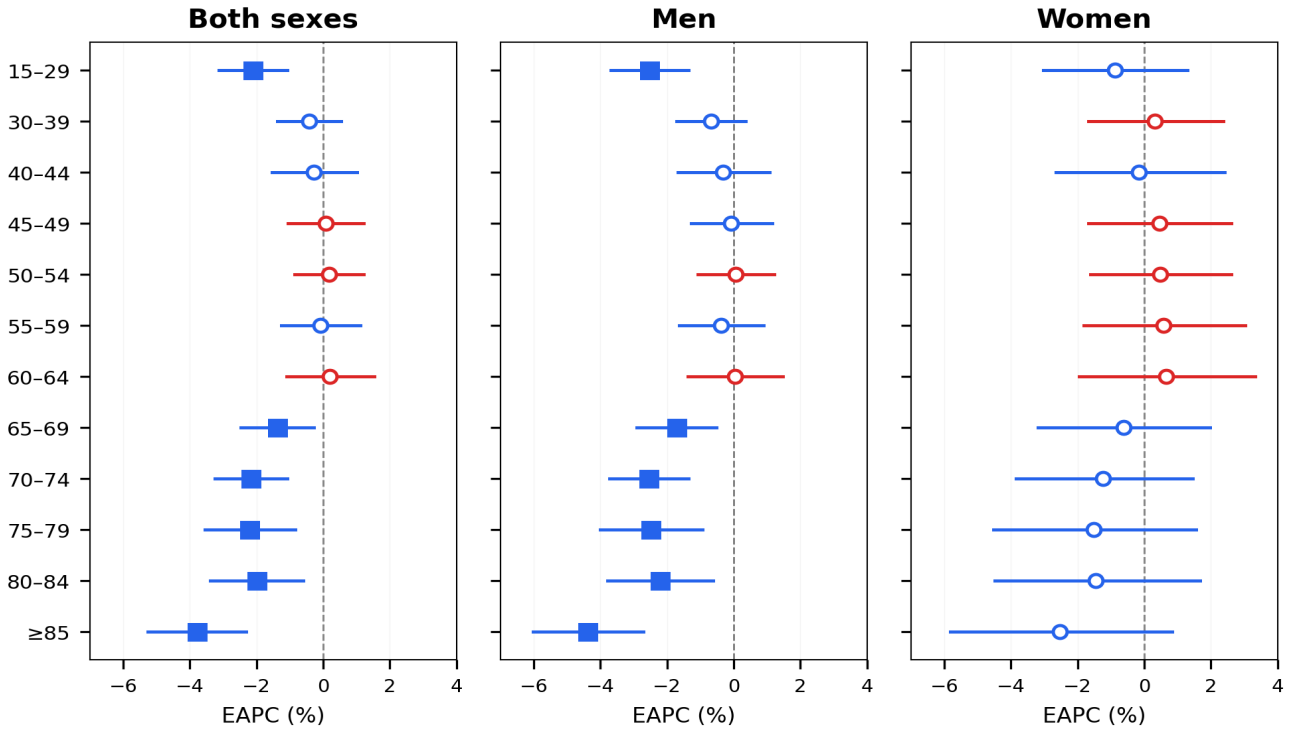

Figure S18. Forest plot of the estimated annual percentage change (EAPC) in age-specific suicide rates by sex, Andalusia 2000–2024. Filled squares: statistically significant EAPC ($p < 0.05$); open circles: not significant. Blue: declining trend (EAPC < 0); red: increasing trend (EAPC > 0). Dashed vertical line: EAPC = 0% (no change). Significant declines concentrated in ages 15–29 and ≥65 for both sexes and men; no significant trends in women. Error bars: 95% confidence intervals.

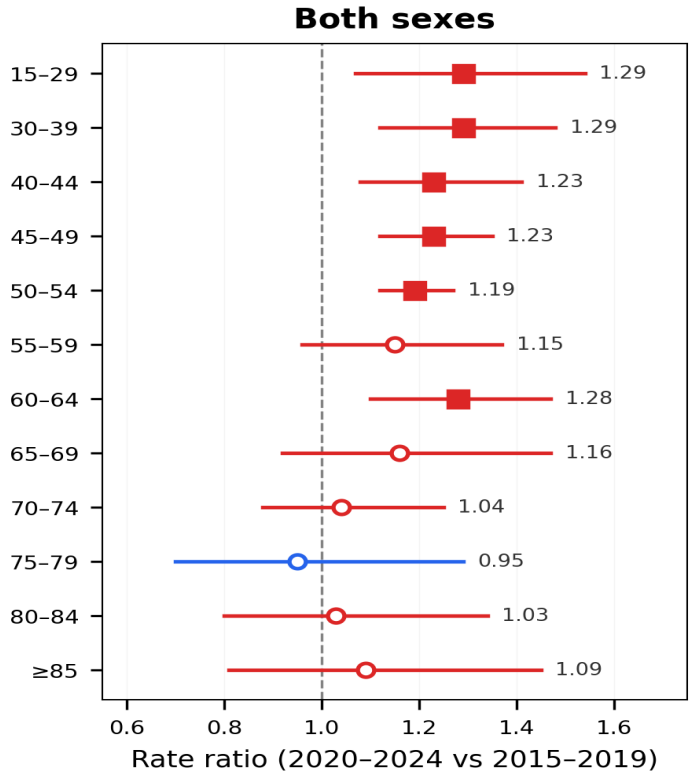

Figure S19. Forest plot of age-specific rate ratios comparing the pandemic quinquennium (2020–2024) to the pre-pandemic period (2015–2019), both sexes. Filled red squares: significant increase (RR > 1, $p < 0.05$); open red circles: non-significant increase; open blue

circle: decrease (not significant). Dashed vertical line: RR = 1.0 (no change). RR values annotated. Six of 12 age groups (all aged 15–64) showed significant increases (RR = 1.19–1.29), while no group aged ≥70 showed significant change, indicating that the pandemic-associated excess was concentrated in working-age adults.

Summary

The age-stratified analyses reveal two complementary findings. First, over the full 25-year period, suicide rates declined significantly among those aged 15–29 and ≥65, with the steepest declines in the oldest groups (EAPC up to −3.79% in ≥85), while working-age rates remained stable. These long-term declines, driven primarily by men, contributed to the demographic masking effect identified in the main text. Second, the pandemic quinquennium was associated with significant rate increases concentrated exclusively in the under-65 population (6/12 age groups, RR = 1.19–1.29), with no significant changes among those aged ≥70. This age-differential pandemic impact suggests that indirect mechanisms (economic stress, social isolation, mental health service disruption) rather than direct pandemic mortality drove the observed excess.