

# COVID-19 CASES AND MONTHLY ALL-CAUSE, CANCER, CVD AND DIABETES MORTALITY IN 16 COUNTRIES, 2020-2021

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## KEY POINTS

- We evaluated the monthly cause-specific excess mortality from cardiovascular diseases, diabetes, and cancer in 16 countries during 2020 and 2021, in relation to COVID-19 peaks.
- Excess mortality from cardiovascular diseases and diabetes persisted through 2021 in several countries, while no excess from cancer was observed.
- Excess mortality from cardiovascular diseases and diabetes coincide with COVID-19 peaks, suggesting an immediate effect of the pandemic on these causes of death.

## BACKGROUND

The COVID-19 pandemic has been associated with increased mortality from various chronic diseases. This study evaluated the monthly excess mortality from all causes, cancer, cardiovascular disease (CVD), and diabetes during 2020 and 2021, and examined their correlation with peaks in COVID-19 cases. With this aim, we retrieved cause-specific mortality data from 16 European and American countries: Argentina, Austria, Brazil, Switzerland, Chile, Czech Republic, Germany, Georgia, Hungary, Italy, Latvia, Lithuania, Mexico, Serbia, Slovakia, and the USA.

## METHODS

Monthly cause-specific mortality data were obtained from national statistical offices' public repositories or obtained directly from them upon request. Population data were obtained from the United Nations archives.

Excess deaths for 2020 and 2021 were calculated as the difference between observed and expected deaths. Expected deaths were estimated using a quasi-Poisson regression model fitted to the 2010-2019 data:

$$\ln(E[deaths_{i,j,k,l}]) = \alpha + \beta_1 sex_i + \beta_2 ns(age\ midpoint_j, df) + \beta_3 ns(month_k, df) + \beta_4 year_l + \beta_5 sex_i \times ns(age\ midpoint_j) + \beta_6 sex_i \times year_l + \ln(pop_{i,j}) + \varepsilon_{i,j,k,l}$$

Where *ns*: natural spline function

The correlation between COVID-19 cases and monthly excess mortality from all causes, cancer, CVD, and diabetes was quantified using Spearman's correlation coefficient (*r*).

## RESULTS

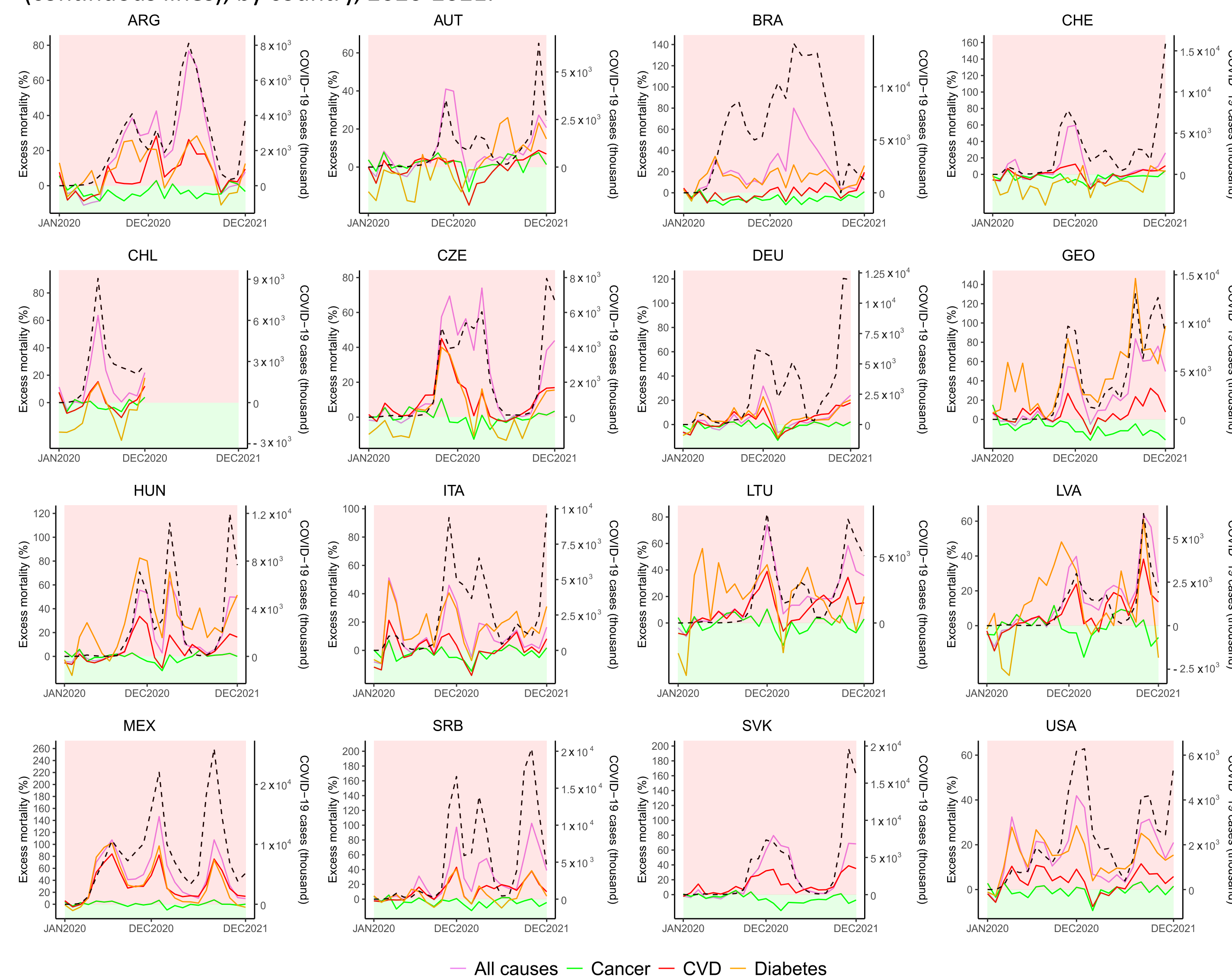
Excess mortality above 5% was identified for all causes in 14 countries in both 2020 and 2021, for CVD in seven countries in 2020 and nine in 2021, and for diabetes in 10 countries in 2020 and 11 in 2021 (Figure 1). No significant excess of cancer mortality was observed.

A positive correlation between COVID-19 cases and monthly excess mortality was observed for all causes in all countries (*r*: 0.61 to 0.91), for CVD in 11 countries (*r*: 0.45 to 0.85) and for diabetes in 13 countries (*r*: 0.42 to 0.79, Figure 2a and 2b).

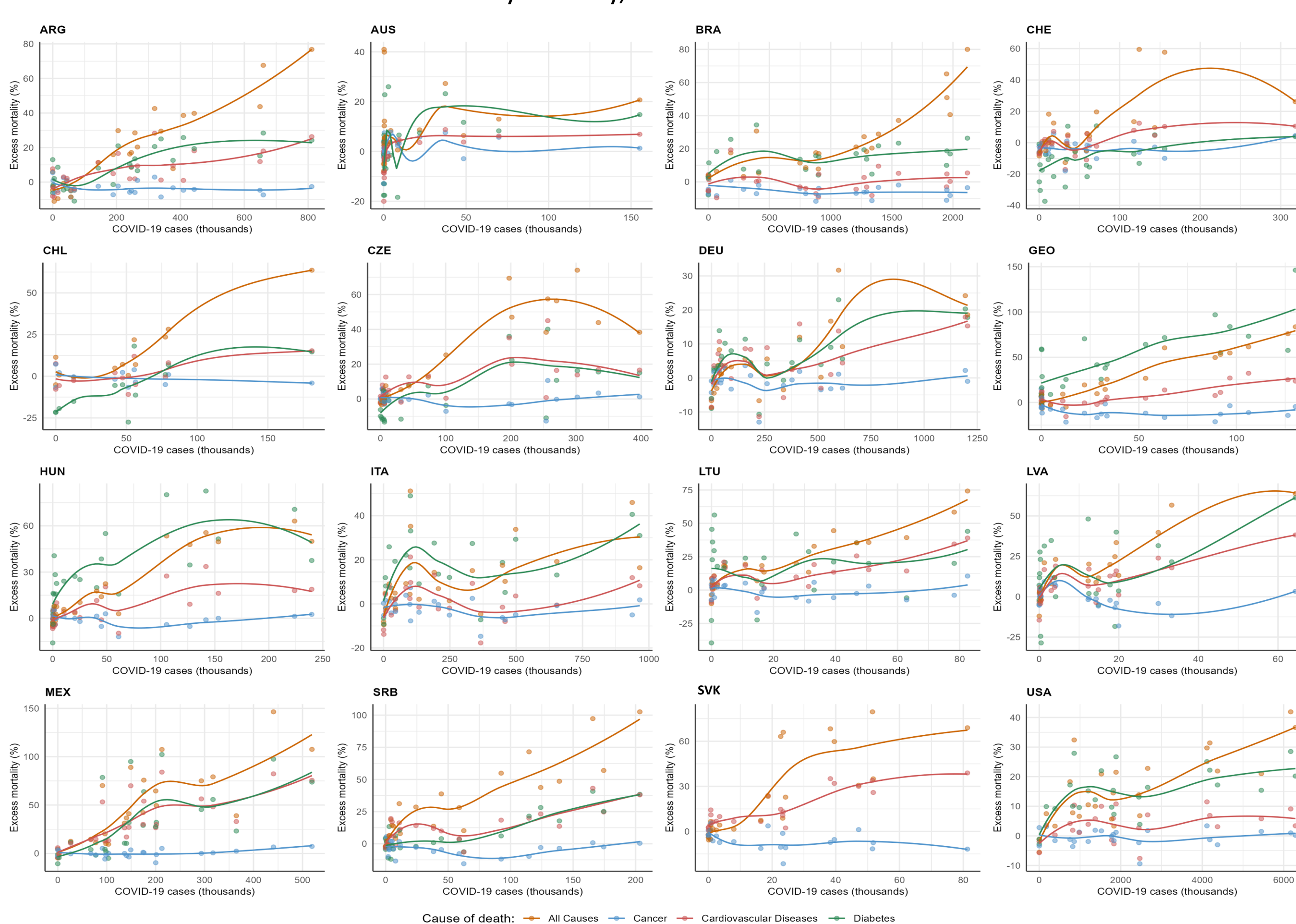
## CONCLUSIONS

This analysis confirmed a direct correlation between COVID-19 cases and excess mortality associated with CVD and diabetes in several countries. The excess of mortality coincided with COVID-19 peaks, suggesting a short-term impact of the pandemic on mortality from vascular and metabolic diseases, but not cancer.

**Figure 1.** Monthly trends in COVID-19 cases (dotted line) and excess mortality (% difference from expected number of deaths) from all causes, cancer, cardiovascular diseases (CVD) and diabetes (continuous lines), by country, 2020-2021.



**Figure 2a.** Correlation between COVID-19 cases and monthly excess mortality from all causes, cancer, cardiovascular diseases and diabetes by country, 2020-2021.



**Figure 2b.** Spearman's correlation coefficients between COVID-19 cases and monthly excess mortality from all causes, cancer, cardiovascular diseases and diabetes by country, 2020-2021.

The significance of the coefficient was tested at  $\alpha=0.05$

ARG	0.87 **	-0.25	0.66 **	0.75 **
AUT	0.76 **	0.15	0.38	0.53 **
BRA	0.88 **	-0.21	0.27	0.46 *
CHE	0.74 **	0.04	0.58 **	0.44 *
CHL	0.71 **	-0.24	0.46	0.73 *
CZE	0.88 **	-0.07	0.65 **	0.67 **
DEU	0.69 **	-0.05	0.45 *	0.60 **
GEO	0.87 **	-0.47 *	0.52 **	0.73 **
HUN	0.89 **	-0.25	0.69 **	0.79 **
ITA	0.61 **	-0.24	0.27	0.42 *
LTU	0.91 **	-0.17	0.67 **	0.10
LVA	0.88 **	-0.37	0.64 **	0.24
MEX	0.84 **	0.31	0.85 **	0.73 **
SRB	0.90 **	-0.18	0.69 **	0.64 **
SVK	0.91 **	-0.50 *	0.83 **	
USA	0.70 **	0.04	0.36	0.55 **
	All causes	Cancer	CVD	Diabetes